APPENDIX I
HYDROGEOLOGY

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
Environmental Impact Assessment

Volume 4: Appendices
Appendix I: Hydrogeology

Hydrogeology Baseline Technical Data Report

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Abbreviations

ASTM	American Society for Testing and Materials
AWWID	Alberta Water Well Information Database
cfu/100 mL	colony forming units per 100 millilitre
CSA	Canadian Standards Association
DEM	digital elevation model
DOC	dissolved organic carbon
GCDWQ	Guideline for Canadian Drinking Water Quality
GIS	geographic information system
GOWN	groundwater observation well network
HPC	heterotrophic plate count
m	metres
mg/L	milligram per litre
mpn/100 mL	most probable number per 100 millilitres
µg/L	Microgram per litre
m ASL	metres above sea level
m BGL	metres below ground level
m^3/day	cubic metres per day
LAA	Local Assessment Area
LiDAR	light detection and ranging
PVC	polyvinyl chloride
PDA	Project Development Area

QA/QC	quality assurance and quality control
RAA	Regional Assessment Area
3D CSM	three-dimensional conceptual site model

1.0 INTRODUCTION

This technical data report includes information on groundwater resources that supports the environmental assessment for the Springbank Off-stream Reservoir Project (the Project):

- lists existing data and project-specific data sources (e.g., regional reports, historical records and field data) and describes the methods used to compile and analyze the data
- describes the structure and thickness of hydrostratigraphic units
- describes the existing chemistry of the hydrostratigraphic units
- identifies the location of known water wells and describes groundwater use in the assessment areas
- identifies methods used to assess potential effects of the Project on groundwater resources
- explains how data were analyzed
- presents results of these analyses
- describes model inputs and parameters used in the numerical groundwater flow model

2.0 METHODS

2.1 DATA COMPILATION AND PRELIMINARY CONCEPTUAL HYDROSTRATIGRAPHIC FRAMEWORK

The preliminary assessment of existing hydrogeological conditions involved compilation and review of data from various publicly available sources, including the following regional reports (among others):

- Surficial Geology of Alberta Foothills and Rocky Mountains (Map 150) (AGS 1980)
- Surficial Geology of Alberta (Map 601) (Fenton et al. 2013)
- Quaternary Geology of Southern Alberta (Map 207) (Shetsen 1987)
- Bedrock Topography of Alberta (Map 602) (MacCormack et al. 2015)
- Geology of the Alberta Rocky Mountains and Foothills (Map 560) (Pana and Elgr 2013)
- Bedrock Geology of Alberta (Map 600) (Prior et al. 2013)
- Prairie Farm Rehabilitation Administration Regional Groundwater Resource Assessment (HCL 2002)
- Alberta Environment Water Well Information Database (AWWID)
- AMEC (2014) Preliminary Geotechnical Investigation
- Hydrogeology of the Canmore Corridor and Northwestern Kananaskis Country, Alberta (Toop and de la Cruz 2013)
- Stratigraphic Framework of the Uppermost Cretaceous to Paleocene Strata of the Alberta Basin (Jerzykiewicz 1997)
- Hydrogeology of the Canmore Corridor and Northwestern Kananaskis Country (Toop and de la Cruz 2002)

In addition to these data sources, Stantec's geotechnical group completed geological mapping of outcrops that could be accessed within the Regional Assessment Area (RAA). Mapping of 18 outcrops was completed in March 2016. The objectives of the mapping were to determine the distribution of lithological units, orientation of the bedding planes, fracture characteristics, and to estimate the strength of the bedrock material.

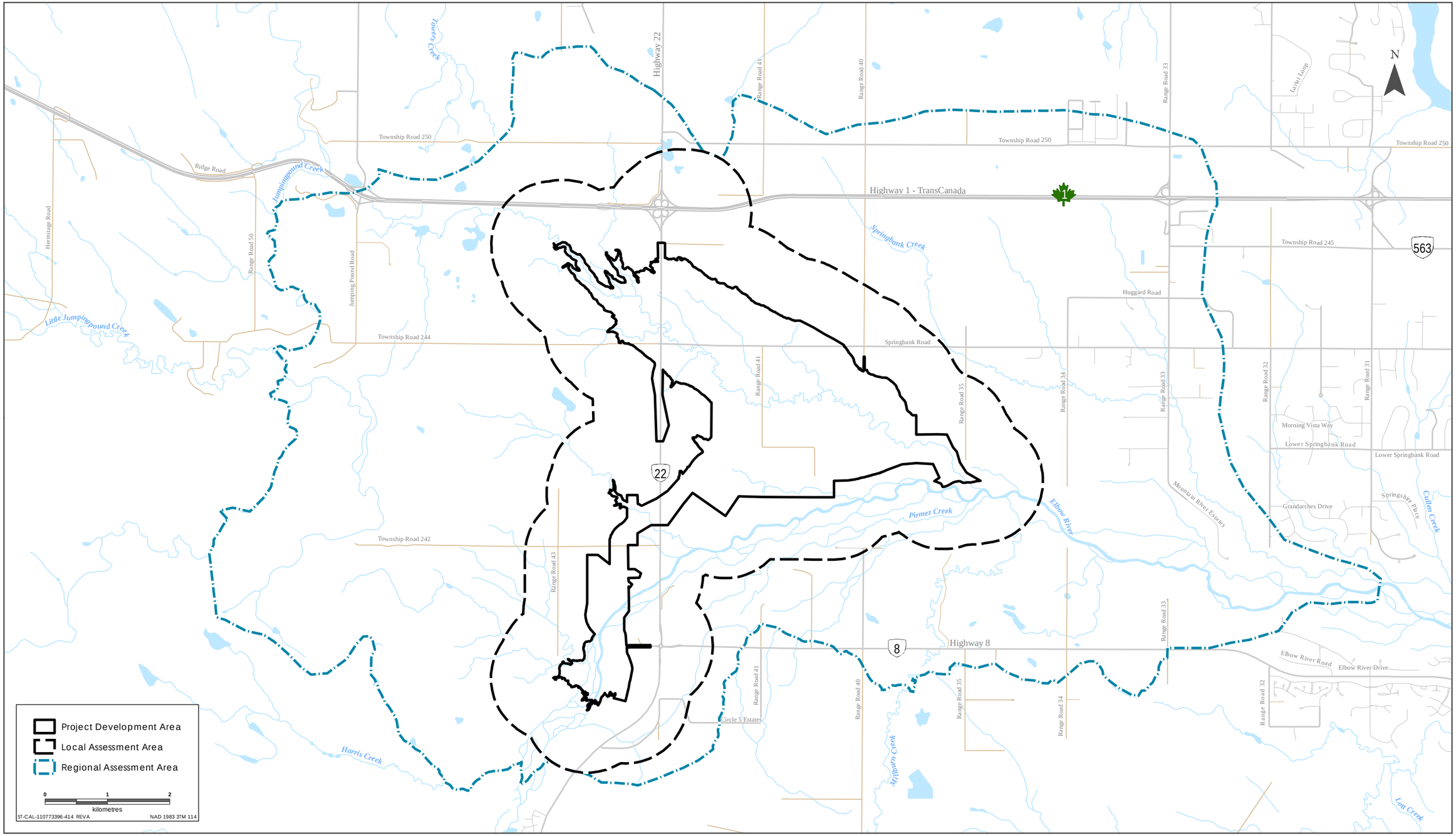
Where outcrops along the Elbow River could not easily be accessed to the west of Highway 22, they were scanned using ground-based light detection and ranging (LiDAR). This work was completed primarily for geotechnical purposes but was also used to support the development of the conceptual hydrostratigraphic framework for the RAA.

All the information and data noted above were reviewed and used to create a preliminary conceptual hydrostratigraphic framework for the region. The preliminary framework was created to support the early stages of the assessment process. The preliminary framework was used in conjunction with the Project description to determine appropriate hydrogeology assessment areas and to guide the hydrogeological field program for the Project. Details regarding the framework and subsequent modelling process are presented in Section 2.6.

2.2 GROUNDWATER RESOURCES ASSESSMENT AREAS

The boundaries of the groundwater resources assessment areas were defined as the area over which potential interactions between the Project and groundwater resources could occur. The horizontal boundaries are presented in plan view in Figure 2-1. The vertical boundaries are defined by the ground surface as the uppermost surface and an arbitrary lower surface at an elevation of 1,000 m ASL. The groundwater resources assessment areas are defined as follows:

- Project Development Area (PDA): The PDA is the area of the physical Project footprint, and consists of the area of physical disturbance associated with the diversions structure, diversion channel, dam and maximum reservoir area behind the dam.
- Local Assessment Area (LAA): The LAA includes the PDA plus a 1-km buffer surrounding the PDA to address potential localized hydrogeological effects, including water level and water quality changes near the construction areas, and localized seepage from the dam. The LAA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur.
- Regional Assessment Area (RAA): The RAA for the Hydrogeology component was chosen based on boundary conditions for the numerical groundwater model. The RAA covers approximately 14,000 ha and is bounded by a surface and shallow groundwater flow divide in the north, an arbitrary boundary to the northwest to encompass the subwatershed of three small tributaries to the Elbow River, the floodplain and terrace of the Elbow River to the south and Jumpingpound Creek to the west.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Groundwater Resources Assessment Area

Figure 2-1

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT
HYDROGEOLOGY BASELINE TECHNICAL DATA REPORT

Methods
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2.3 DRILLING AND MONITORING WELL INSTALLATION

The hydrogeological field program plan was developed based on the preliminary conceptual hydrostratigraphic framework presented in Section 2.1 and the Project description. The planned geotechnical field program was also reviewed to reduce redundancies in drilling locations such that information from both investigations could be better leveraged in a synergistic manner. Table 2-1 summarizes the borehole drilling and monitoring well installation program. The borehole and monitoring well locations are presented in Figure 2-2. The locations were chosen based on the information in the preliminary hydrostratigraphic framework, as well as land access restrictions and physical constraints identified in the field, including underground utilities, pipeline right-of-way and drilling rig access restrictions.

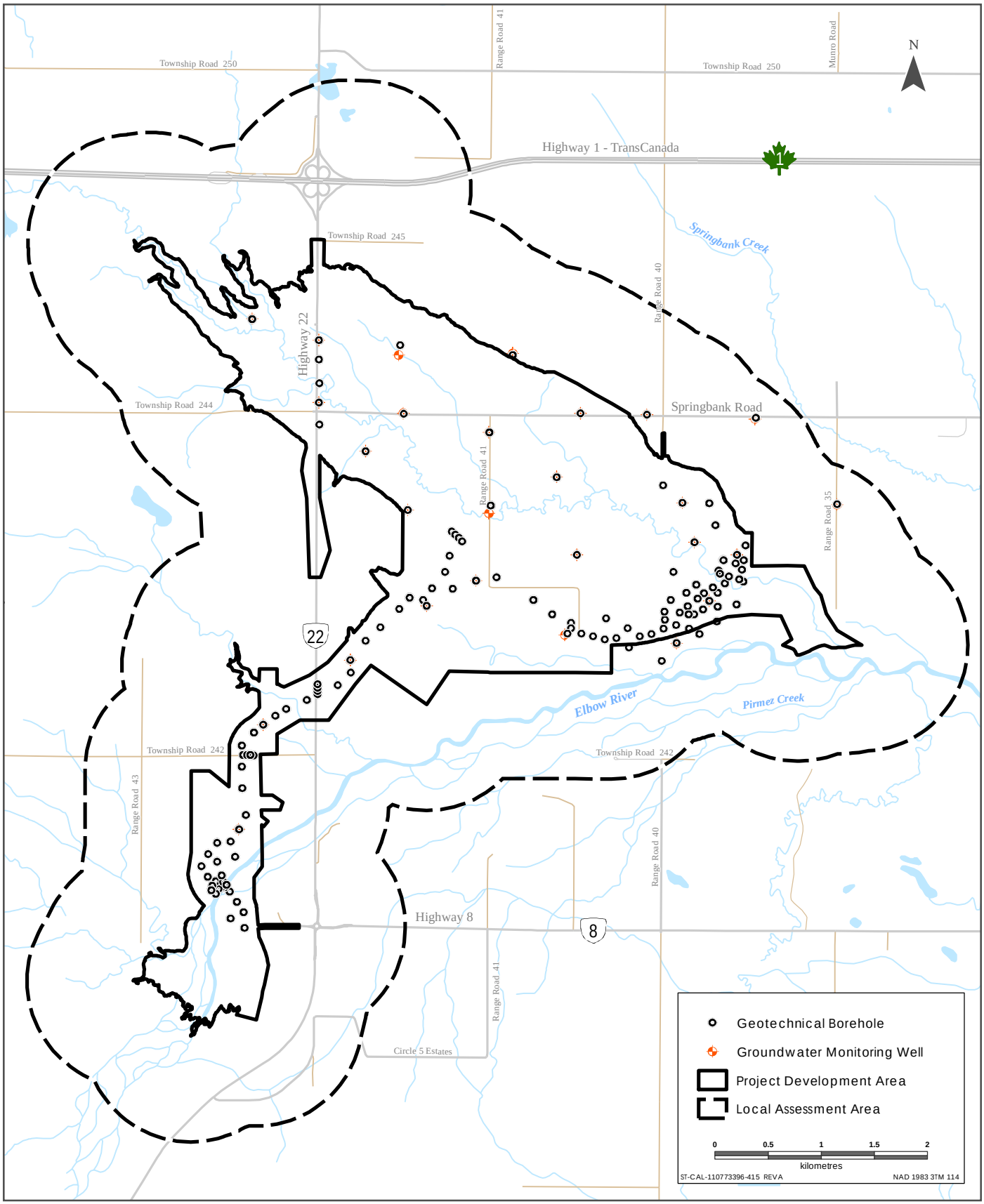
Table 2-1 Monitoring Well Completion Details

Well Name	Borehole Name	3TM Easting[1]	3TM Northing[1]	Ground Elevation (m ASL)	Borehole Depth (m BGL)	Screen from (m BGL)	Screen to (m BGL)	Completion Unit	Pressure Transducer/ Logger	Response Tested
MW16-1-15	GW1	5659967.3	-33327.5	1211.71	16.8	12.2	15.2	Sandstone	Yes	Yes
MW16-2-6	GW2	5659623.9	-31947.3	1204.26	13.7	3.1	6.1	Glaciolacustrine Clay		
MW16-3-7	GW3	5659073.5	-31904.4	1201.07	7.6	3.7	6.7	Glaciolacustrine Clay and Silt		
MW16-4-22	GW4	5658717.4	-32259.3	1204.30	22.9	18.6	21.6	Sandstone		Yes
MW16-5-11	GW5	5658164.7	-31863.2	1210.63	22.9	8.2	11.3	Sandstone		
MW16-6-11	GW6S	5658135.3	-31100.5	1195.44	10.7	7.3	10.4	Till	Yes	
MW16-6-20	GW6D	5658133.9	-31100.4	1195.51	22.9	18.9	21.9	Claystone/ Siltstone	Yes	Yes
MW16-7-5	GW7	5658895.2	-31098.8	1199.28	9.1	2.1	5.2	Glaciolacustrine Clay and Silt	Yes	
MW16-8-8	GW8S	5659641.1	-30875.7	1218.16	7.9	6.1	7.6	Till	Yes	
MW16-8-19	GW8D	5659641.2	-30877.5	1218.13	20.4	16.5	18.6	Sandstone	Yes	Yes
MW16-9-6	GW9	5659076.8	-30236.4	1204.52	6.1	4.3	5.8	Glaciolacustrine Clay and Silt		Yes
MW16-10-15	GW10	5658478.2	-30461.4	1195.40	18.3	12.2	15.2	Till		Yes
MW16-11-15	GW11	5657742.9	-30269.8	1193.68	15.2	11.6	14.6	Till		
MW16-12-3	GW12	5657858.3	-29160.3	1189.98	12.2	1.5	3.1	Till	Yes	
MW16-13-37	GW13	5659064.0	-29610.3	1222.34	37.2	33.5	36.6	Claystone		
MW16-14-33	GW14	5659018.4	-28592.2	1202.24	33.5	30.5	33.5	Siltstone/ Claystone		

Table 2-1 Monitoring Well Completion Details

Well Name	Borehole Name	3TM Easting[1]	3TM Northing[1]	Ground Elevation (m ASL)	Borehole Depth (m BGL)	Screen from (m BGL)	Screen to (m BGL)	Completion Unit	Pressure Transducer/ Logger	Response Tested
MW16-15-34	GW15	5658214.9	-27818.8	1190.10	35.0	32.9	34.4	Siltstone	Yes	
MW16-16-11	DC-9	5655154.3	-33453.6	1227.47	14.1	7.6	10.7	Till		
MW16-17-5	DC-15	5656140.6	-33226.5	1213.52	11.2	3.7	5.2	Glaciolacustrine Clay		
MW16-18-6	DC-21S	5656749.5	-32406.6	1216.04	6.1	4.0	5.5	Basal Silt and Sand	Yes	
MW16-18-10	DC-21D	5656750.6	-32406.7	1216.03	12.5	9.1	10.6	Claystone		Yes
MW16-19-8	DC-25S	5657262.2	-31684.6	1202.73	7.6	6.1	7.6	Basal Silt and Sand		
MW16-19-19	DC-25D	5657263.2	-31684.5	1202.80	23.2	17.1	18.6	Sandstone		Yes
MW16-20-21	D2	5657498.6	-31218.4	1206.60	21.3	19.8	21.3	Sandstone		
MW16-21-11	D9	5656987.1	-30383.8	1202.61	14.1	9.0	10.5	Sandstone		
MW16-22-26	D27	5656907.3	-29330.9	1190.70	27.4	22.9	25.9	Till		
MW16-23-14	D36S	5657309.6	-29019.7	1190.54	14.0	11.0	14.0	Till		
MW16-23-36	D36D	5657308.3	-29019.3	1190.56	45.7	35.68	37.18	Siltstone		
MW16-24-30	D51	5657740.5	-28761.8	1194.50	30.8	29.0	30.5	Sandstone		Yes
MW16-25-9	BS3	5658231.0	-29274.7	1197.44	9.4	6.1	9.1	Till		Yes
MW16-26-18	H6	5659178.1	-32702.7	1204.56	18.3	15.8	18.3	Claystone	Yes	
MW16-27-12	H9	5659766.2	-32702.3	1207.67	18.9	10.1	11.6	Till		

NOTE:
[1] Coordinate system is NAD83 3TM 114



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Groundwater Monitoring Well and Geotechnical Borehole Locations

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Prior to drilling, borehole locations were staked in the field. Once staked, Stantec's geomatics group surveyed the locations and completed utility sweeps around each borehole location. Alberta One Call underground utility locates were then completed.

The field program included drilling the following boreholes to characterize the hydrostratigraphy of the LAA, as summarized in Table 2-1:

- 17 shallow boreholes completed to depths ranging from 3.1 to 25.9 m BGL to assess the unconsolidated Quaternary Aged deposits
- 15 deep boreholes completed to depths ranging from 10.5 to 42.7 m BGL to characterize the upper bedrock units

The installations summarized above also included nested installations at five locations, with one well completed in the unconsolidated deposits and one well completed deeper in bedrock. The nested installations were completed to characterize the deeper hydrostratigraphy and to determine the vertical hydraulic gradients beneath the LAA.

The 32 boreholes and monitoring wells were completed between May 1 and August 29, 2016. The drilling program was completed in conjunction with the geotechnical drilling program, which was conducted from March 21 to August 25, 2016. The length of both field programs was longer than anticipated because of land access restrictions and weather-related delays. The hydrogeology drilling program was completed by All-Service Drilling and included a combination of auger, ODEX and rotary coring. A Stantec hydrogeologist was on-site for the drilling and monitoring well installations, and performed the following tasks:

- coordinating land access
- reviewing borehole locations and utility locates
- supervising subcontractors
- logging of the auger cuttings, ODEX returns and core
- determining appropriate well completion intervals based on field observations

To maintain consistency with the geotechnical drilling program, the borehole names for the monitoring wells that overlap between the geotechnical and hydrogeological drilling programs include a prefix to reference particular Project components as follows:

- D – Dam
- DC – Diversion Channel
- DS – River Structures (Service Spillway and Diversion Inlet)
- BS – Borrow Source
- H – Highway embankment and bridge

Boreholes with the monitoring wells installed use the prefix "MW" for monitoring well, followed by the year of installation, a unique well identifier and the approximate completion depth in metres. For example, monitoring well MW16-1-15 was completed in 2016 at location 1 and the bottom of the completion interval is at a depth of approximately 15 m BGL.

Drilling of the unconsolidated material above bedrock was completed using a track- or truck-mounted auger drilling rig. Drilling through the bedrock material involved a combination of auger drilling where conditions would allow (weathered or weakly lithified bedrock), air rotary, and rotary coring where required as part of the geotechnical field program.

Samples were collected at varying intervals in conjunction with the geotechnical drilling program and included undisturbed Shelby tube samples and bulk samples of auger cuttings. Samples were stored in moisture-tight containers and transported to the Stantec laboratory in Calgary for testing. While most sampling and testing was specific to the geotechnical investigation, a number of tests were also used to support the hydrogeological assessment, including:

- moisture content (ASTM D2216, CSA A23.2-11A)
- particle size distribution by sieve analysis (ASTM D422)
- particle size distribution by hydrometer (ASTM D422)
- permeability test, flexible wall/falling head (ASTM D5084)

Borehole logs for each drilling location are presented in Attachment A.

The shallower monitoring wells were installed with screened intervals within the first water-bearing unit encountered. The deeper (bedrock) monitoring wells were installed in the first water-bearing bedrock unit, excluding the weathered upper portion of the bedrock, which was generally in hydraulic communication with the unconsolidated deposits.

Monitoring wells were constructed of 51 mm (2") flush threaded Schedule 40 polyvinyl chloride (PVC) pipe and end caps. Well screens were constructed from flush threaded 10 slot (0.010") PVC. The length of well screens varied from 1.5 to 3.1 m depending on the characteristics of the water-bearing interval encountered. Shorter screens were used where discrete water-bearing intervals could be identified and targeted, while longer screens were used where water-bearing intervals were thicker or not easily identifiable. Monitoring wells were completed with either flush-mounted protectors or aboveground steel casing protectors installed over the PVC well casing, depending on landowner requirements. Monitoring well completion details are presented in the borehole logs in Attachment A.

Following drilling and completion of the monitoring wells, each well was developed by pumping until most fines were removed or until dry (in the case of low-yielding wells). The purpose of development is to remove fine-grained materials from around the filter pack, improve the hydraulic efficiency of the filter pack and improve hydraulic communication between the filter

pack and geologic formation. Well development results in more representative groundwater samples and improved hydraulic conductivity estimates.

A horizontal and vertical (geodetic) survey of new monitoring well locations was completed by Stantec's geomatics group to allow for the determination of accurate water level elevations. Precise elevation control is required for interpretation of hydraulic gradients and groundwater flow. Survey coordinates for the well locations are presented in Table 2-1.

2.4 HYDRAULIC CONDUCTIVITY TESTING

After the new monitoring wells were developed and water levels had recovered to static, rising head response tests were attempted at 15 representative monitoring wells to collect information to estimate the hydraulic conductivity of the materials adjacent to the completion intervals. A number of monitoring wells did not have sufficient water to perform the tests, or water had not reached a static level at the time of testing due to slow recovery. In total, 10 successful response tests were completed.

In addition to the single well response test, packer testing was completed as part of the geotechnical drilling program. In total, 37 single packer permeability tests were conducted in five boreholes to determine the permeability of the bedrock interval. The tests were completed at the base of the borehole as the borehole was advanced.

2.5 GROUNDWATER MONITORING AND ANALYSIS

The groundwater monitoring program was conducted by Stantec personnel between September 27 and October 6, 2016. It included the following tasks:

- measuring and recording depth to water and depth to bottom of well (total depth)
- purging each monitor of three well volumes or until they were essentially dry, using a combination of dedicated bailers and electric pumps
- obtaining field measurements of temperature, pH and electrical conductivity at the time of sample collection
- labelling sample containers with the monitor number, date of collection and analyses required, prior to collection of the sample
- collection and preservation (where required) of representative groundwater samples in laboratory-supplied containers
- collection of blind duplicate samples for quality assurance and quality control (QA/QC) purposes
- transport of samples in temperature-moderated coolers and submission of samples to Maxxam Analytics laboratory in Calgary, Alberta

In total, 31 of the 32 new monitoring wells were monitored and sampled. The remaining monitoring well (MW16-13-37) could not be located and may have been destroyed during re-grading and addition of gravel to fix rutting caused during the drilling program. In total, 33 samples, including two duplicate QA/QC samples, were submitted for analysis of the following parameters in order to characterize existing groundwater chemistry:

- routine chemistry parameters
- dissolved metals (including low-level mercury)
- total mercury (low level)
- nutrients (ammonia, total Kjeldahl nitrogen, orthophosphate, phosphorus)
- dissolved organic carbon (DOC)
- benzene, toluene, ethylbenzene, xylenes and F1 to F2 fraction hydrocarbons
- bacteriological parameters (heterotrophic plate count, total coliforms, fecal coliforms)

Data logging pressure transducers were installed in 10 monitoring wells during the groundwater monitoring program to record ongoing pressure data. One barometric pressure transducer was also deployed to record atmospheric pressure required to correct the pressure data from the other transducers. All loggers were set to record pressure data on an hourly basis. The data can then be downloaded from the loggers and used to calculate potentiometric elevations.

2.5.1 Quality Assurance and Quality Control

Quality assurance and quality control protocols were implemented during sample collection, storage and transport, including:

- use of disposable nitrile gloves and dedicated bailers for purging monitoring wells and collecting samples
- decontamination and rinsing of the water level meter and water quality probe between each monitoring well
- storage of samples at moderate temperature in coolers during storage and transport
- collection of duplicate groundwater samples during monitoring
- submission of samples to Maxxam Analytics Inc., a Canadian Association for Laboratory Accreditation accredited laboratory, under standard chain of custody protocols

Duplicate groundwater samples were collected as part of the QA/QC program to evaluate the precision or reproducibility of the analytical data between samples. Two blind duplicate samples were submitted along with the groundwater sample submissions.

2.6 DEVELOPMENT OF THE THREE-DIMENSIONAL CONCEPTUAL SITE MODEL

The publicly available data summarized in Section 2.1 and the Project-specific field data were used to build a three-dimensional conceptual site model (3D CSM) for the groundwater resources within the RAA. The 3D CSM covers approximately 14,000 ha based on the boundary of the RAA described in Section 2.2.

The intent of the 3D CSM was to synthesize the available data to:

- improve the understanding of the local and regional physiographic setting
- develop a hydrostratigraphic framework of the RAA
- provide the basis for the numerical groundwater flow and contaminant transport modelling to be used in the effects assessment of the environmental impact assessment

The 3D platform allows for more effective conceptualization and clearly demonstrates the relationships between the geology, hydrogeology, monitoring network and other physical features of the RAA. The 3D volumes created in the model can also be exported directly for use in numerical modelling software. This section summarizes the process used to construct the 3D CSM. A discussion of the salient features of the 3D CSM is presented in Section 3.1.

LiDAR data for the RAA were obtained from AltaLIS to form the topographical layer of the model. The AltaLIS "LiDAR 15 DEM" data were processed into 15-m post spacing with an accuracy of 30 cm, which is used to create a high-resolution digital elevation model (DEM). Recent air photo coverage of the RAA, regional maps and GIS shapefiles were also added to the model and overlaid on the topography.

Construction of the modelled surfaces and volumes was based on the compilation of stratigraphic structure elevation interpretations (picks) from the borehole drilling program described in Section 2.2, additional picks from selected records held in the Alberta Water Well Information Database (AWWID) and bedrock elevation picks from the HCL (2002) regional groundwater assessment. Regional geological reports and mapping products described in Section 2.5 were also used to guide the interpretation of the hydrostratigraphic framework.

Lithological data for areas within the LAA used the 32 borehole logs from the hydrogeological field investigation and the additional 125 borehole logs from the geotechnical investigation. Additional lithological data for both the LAA and RAA were obtained from bedrock elevation picks established by HCL (2002), water well drilling records from the AWWID and interpretations based on regional mapping products discussed in Section 2.1. In total, 377 bedrock elevation picks from the HCL (2002) report were incorporated into the model; well records that did not encounter bedrock were culled from the data used in the 3D CSM. Development of the hydrostratigraphic framework within the LAA was derived primarily from the interpretation of borehole lithologies and descriptions. For areas outside the LAA, the unconsolidated deposits

were interpreted based on AGS Map 601 (Fenton et al. 2013) and assumed unit thicknesses based on drilling results within the LAA. An additional 25 AWWID records outside the LAA (but within the RAA) were added to the model to provide additional interpretation and verification of the modelled surfaces.

Figure 2-3 presents the distribution of the monitoring wells, AWWID drilling records and HCL (2002) bedrock picks across the CSM domain.

The compiled hydrostratigraphic picks were used to develop the 3D CSM using Leapfrog Hydro software. The modelling was completed in an iterative process whereby reinterpretation or culling of boreholes that were inconsistent with the overall hydrostratigraphic framework was conducted during each iteration.

An interpreted potentiometric surface for the unconsolidated deposits and potentiometric surface for the bedrock units were created for the RAA. A potentiometric surface represents the elevation to which water would rise due to pressure in the aquifer if it was not confined, and is equivalent to the water table in the unconfined areas of the aquifer. Potentiometric surfaces have been prepared for the surficial aquifer in the unconsolidated Quaternary deposits and for the undifferentiated shallow bedrock aquifer.

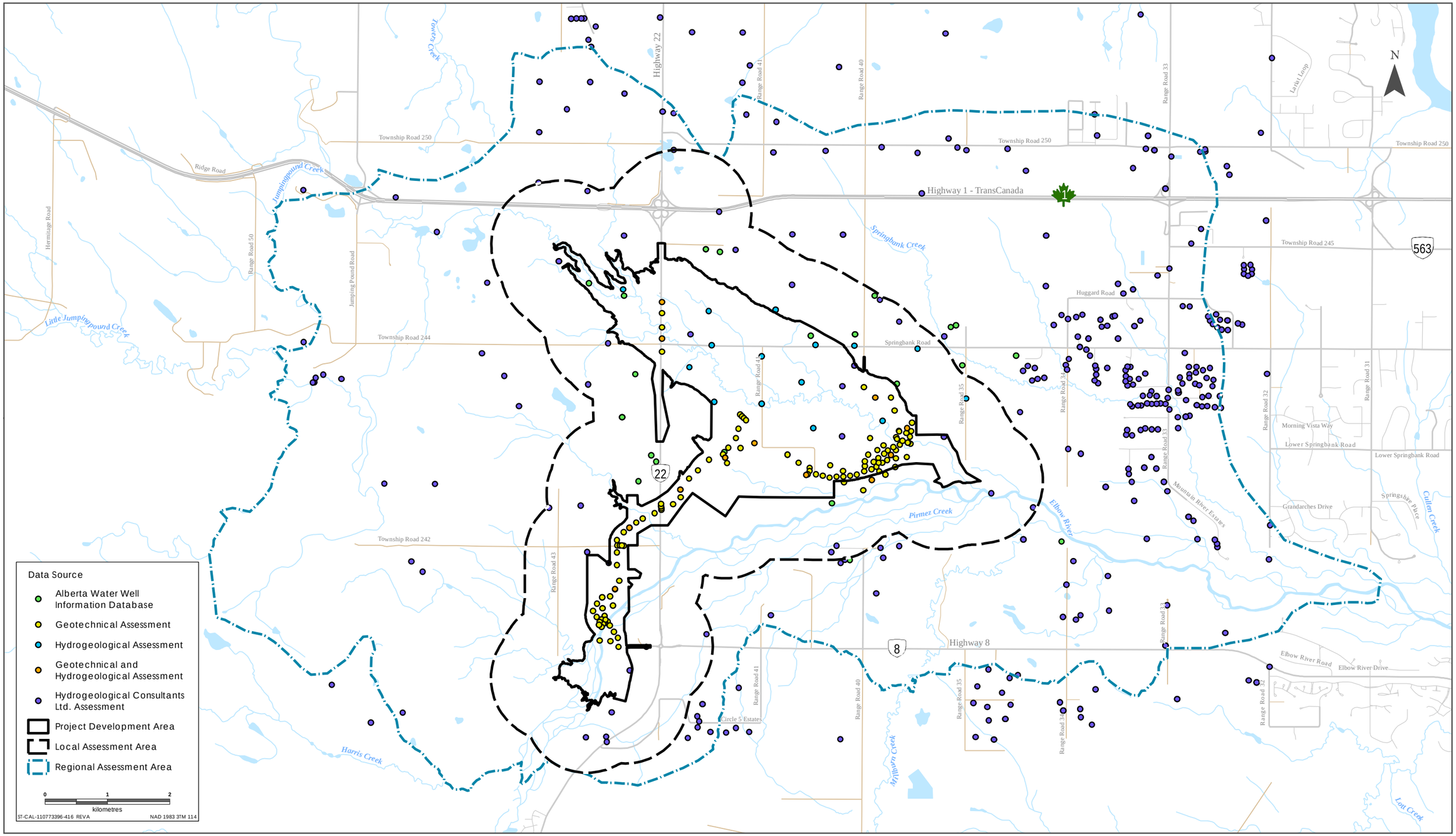
The potentiometric surface in the unconsolidated deposits is based on a combination of Project-specific groundwater monitoring data, water level data from AWWID drilling records, and surface water elevations where shallow groundwater intersects the land surface. The water levels within the LAA are well described based on the data gathered during the Project-specific field program. Outside the LAA, water levels were derived from the AWWID and Lidar data. Hydraulic head values were calculated based on elevations obtained from the LiDAR data for the Project and the recorded non-pumping static water levels in the database.

Data on water levels that were stored in the AWWID required processing to records that are not representative of the upper bedrock units. Water levels for individual well records in the AWWID were manually removed if:

- wells were completed at depths greater than 80 m BGL
- they appeared anomalous compared with water levels in nearby groundwater wells
- the completion interval was inconsistent with surrounding wells

In the case of multiple adjacent completions, the well with the uppermost completion interval was used in an attempt to reduce the possible effect of vertical hydraulic gradients on the gridded potentiometric surface.

Despite screening of the data, variations in the potentiometric surfaces may have also resulted from uncertainty in the elevation control based on the DEM, temporal variations in water level measurements, pumping conditions at measured or nearby wells, multiple aquifer completions, vertical hydraulic gradients and groundwater flow.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Lithological Data Used in the 3D CSM

Figure 2-3

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ENVIRONMENTAL IMPACT ASSESSMENT
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3.0 RESULTS

3.1 CONCEPTUAL HYDROSTRATIGRAPHIC FRAMEWORK

The conceptual hydrostratigraphic framework for the LAA and RAA that is presented in this section is based on the 3D CSM.

Figure 3-1 presents an oblique view of the 3D CSM sliced through the RAA from southwest to northeast. A portion of the PDA (red) is shown overlain on the topography for reference. Figure 3-1 shows how the lithological interval data are integrated into the 3D environment and are depicted as multicoloured intervals projected onto each borehole trace. The black intervals represent undifferentiated bedrock material from the AWWID. In the Project boreholes where the bedrock lithology has been described in detail, the more porous and permeable intervals (sandstone and siltstone) are depicted in red, while the less permeable intervals are depicted in grey (claystone, mudstone and shale). Above the bedrock, the unconsolidated deposits are depicted on the borehole traces as follows:

- Yellow – basal silt, sand and gravel
- Green – till
- Blue – glaciolacustrine clay
- Orange – recent fluvial sand and gravel

Minor coals seams and thin bentonite beds were also noted in some boreholes but are not visible at the scale of the figure.

The modelled volumes in Figure 3-1 use a colour scheme that is similar to that of the borehole traces. Bedrock is shown as undifferentiated in grey at the base of the model. Moving upward in succession, the coarse-grained material at the base of the till is shown in yellow, and the till is shown in green. The glaciolacustrine clay is depicted in blue, and the recent fluvial deposits along the Elbow and Jumping Pound Rivers are depicted in orange.

A regional stratigraphic column that shows the generalized stratigraphy beneath the RAA is depicted in Figure 3-2. Brief descriptions of each stratigraphic unit, and a discussion of the additional salient features of the model are presented below. The descriptions and interpretation are based on the existing geological data sources summarized in Section 2.5 and information gathered as part of the hydrogeological and geotechnical field programs for the Project, described in Sections 2.2 to 2.4.

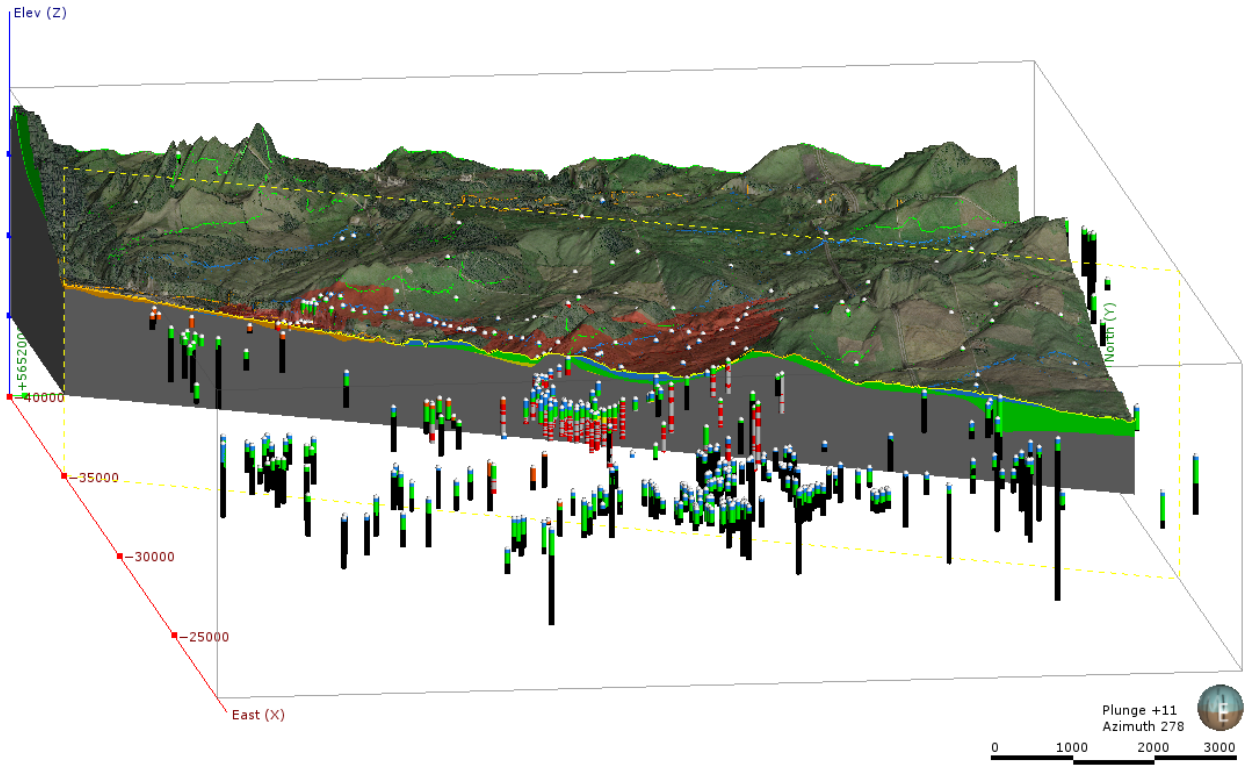


Figure 3-1 Southwest–Northeast Slice through the 3D Hydrostratigraphic Model

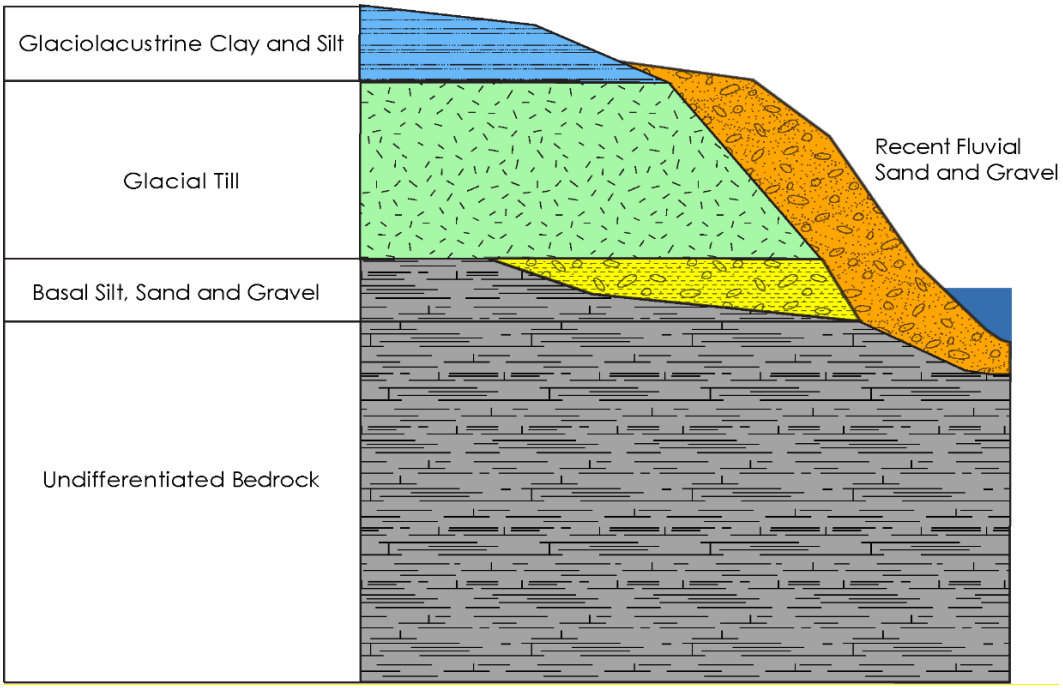


Figure 3-2 Regional Stratigraphic Column

3.1.1 Topography

The ground surface topography of the RAA is depicted by the digital elevation model (DEM) in Figure 3-3. Areas of higher elevation are denoted by red, and they grade down to areas of relatively low elevation, denoted by blue. The topographic elevation ranges from approximately 1365 m ASL on the bedrock ridges in the southwest corner of the RAA to approximately 1125 m ASL along the Elbow River at the eastern boundary.

The RAA consists of a series of ridges and valleys oriented northwest to southeast. The topography of most of the RAA is controlled by the bedrock structure and glacial deposition. Prominent ridges through the assessment area are a result of formations that are more resistive to weathering; the valleys in between the ridges are more easily weathered or recessive.

In the vicinity of the modern river channels, fluvial erosion and deposition is the primary control agent. Near the Elbow and Jumping Pond Rivers, the terrain is incised with one or more fluvial terraces within the river valleys. Hummocky regions have low to moderate relief, with gentle slopes that vary between 2 and 15%. Areas with low relief are generally underlain by till or glaciolacustrine sediments, while areas of moderate relief are underlain by till and glaciofluvial sediments. Outcrops of bedrock occur in the RAA and are moderately weathered and fractured.

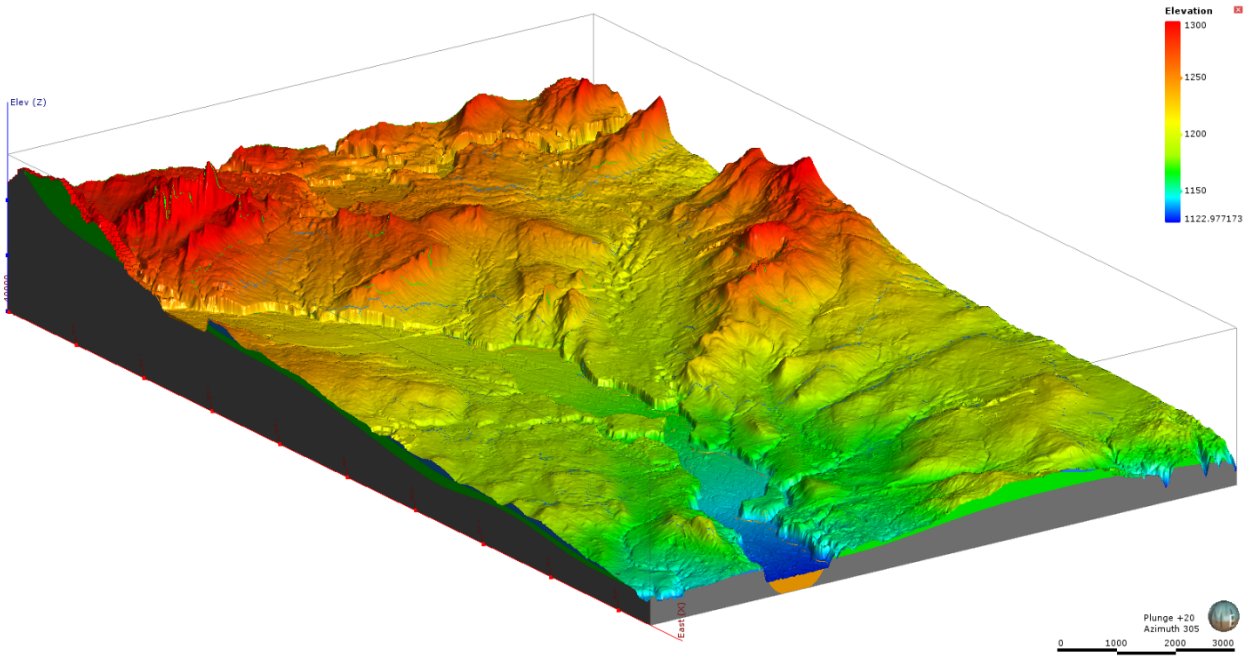


Figure 3-3 Topography of the RAA

3.1.2 Bedrock

The bedrock surface within the RAA was shaped by a number of processes, including the formation of the Rocky Mountains to the west, glacial erosion, and incision of modern-day river channels. The RAA is located in the disturbed belt which forms a transitional zone (foothills) between the Rocky Mountains to the west and prairie to the east. Bedrock topography is depicted in Figure 3-4.

The bedrock units encountered beneath the quaternary deposits from west to east (also oldest to youngest) across the assessment area include the following:

- **Wapiabi Formation** – The Upper Cretaceous-aged Wapiabi Formation of the Alberta Group is generally composed of shale and mudstone with minor siltstone, with the exception of the Chungo and Marshybank Members, which are sandstone dominated (Pana and Elgr 2013).
- **Brazeau Formation** – The Upper Cretaceous-aged Brazeau Formation is composed primarily of sandstone and laminated siltstone, along with olive green mudstone and granule to pebble conglomerate in the lower part. The upper part is composed of greenish-grey to dark grey mudstone, siltstone and greenish-grey sandstone. Thin coal and coaly shale beds and thin bentonite layers also occur in the upper part (Prior et al. 2013). In the foothills, the

Brazeau Formation is the approximate lateral equivalent of the Scollard Formation on the plains (Hamblin 2010).

- **Coalspur Formation** – This Upper Cretaceous to Tertiary aged deposit formed as a marginal marine fluvial infill of the foreland basin. The Coalspur Formation is composed of thinly bedded to massive sandstone, siltstone, light grey to olive green mudstone, shale, coaly shale, coal seams and minor volcanic tuff in the lower portions (Pana and Elgr 2013).
- **Paskapoo Formation** – The Tertiary-aged Paskapoo Formation is made up of thick tabular sandstone, siltstone and mudstone (Glass 1990). The sandstones are fine to coarse grained and are cliff forming. The Paskapoo Formation also contains a significant amount of shale, carbonaceous shale, siltstone, rare coals seams and shell beds (Pana and Elgr 2013). In the central Rocky Mountains and foothills, the Paskapoo Formation is dominated by recessively weathering, grey to greenish-grey mudstone and siltstone with subordinate pale grey, thick- to thin-bedded, commonly cross-stratified sandstone; minor conglomerate; mollusc coquina; and coal (Prior et al. 2013). The Paskapoo Formation is the primary bedrock aquifer in the Elbow River watershed. Due to the stratigraphy of the layers of sandstone and shale within this formation, multiple aquifers occur at various depths in the rock (Waterline 2011). In the Project area, the yield value for the Paskapoo Formation aquifer is 35–175 m^3/day (Waterline 2011).

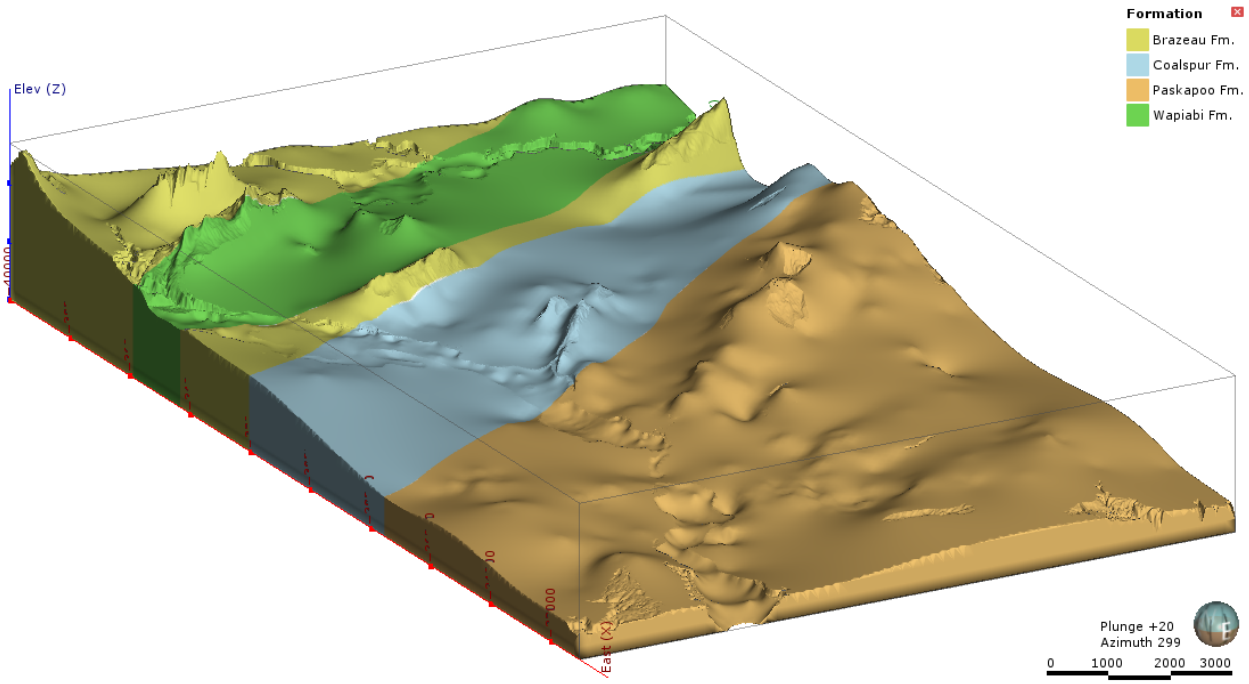


Figure 3-4 Bedrock Topography and Subcrop Formations

The approximate subcrop boundaries of the bedrock units are presented in Figure 3-4, and are based on regional mapping by Pana and Elgr (2013), with the exception of the contact between the Coalspur and Brazeau Formations. This contact was reinterpreted by Jerzykiewicz (1997) based on observation and description of the entrance conglomerate in outcrop along Highway 22. The entrance conglomerate marks the boundary between these two formations, and its presence was confirmed in the field by Stantec.

For the purposes of the 3D CSM, the bedrock units were not differentiated for a number of reasons, including the following:

- All bedrock units were found to have similar lithologies (alternating sandstone, siltstone and claystone), and were inferred to have similar hydraulic properties.
- Significant fracturing was noted in the bedrock, but no spatial relationships between fracture angle, intensity or connectivity could be identified.
- No spatial correlation in hydraulic conductivity values was noted.
- Regional mapping by HCL (2002) indicated that the permeable units of the Brazeau, Coalspur and Paskapoo Formations have the same range of apparent transmissivity in the RAA, as discussed in Section 3.3.
- Significant marker horizons or distinguishing lithological characteristics required to make positive formation assignments were not identified on the borehole logs or in the core at the depths of the investigation.

The bedrock descriptions included on the borehole logs in Attachment A generally consist of varying thicknesses of alternating siltstone, sandstone mudstone and claystone. Descriptions of each of these lithological units were as follows:

- **Sandstone** – Grey to brown, fine to medium-grained sandstone ranging from completely unlithified to well cemented and dry. Significant fracturing was noted in many intervals, with oxidation common along fracture planes. The upper sandstone beds beneath the unconsolidated deposits were highly weathered. Thicknesses of individual sandstone beds ranged from thin, centimetre-scale beds to a maximum of 15.3 m and an average thickness of 2.5 m.
- **Siltstone** – Grey to brown and in some intervals greenish-grey siltstone. Extremely weak and friable to well cemented. Highly fractured in some intervals, with oxidation along fracture planes. The average thickness of the interbedded siltstone beds was 2.5 m.
- **Claystone** – Medium grey to brown claystone, generally blocky and not fissile-like shale, dry except where fractures are saturated. Fracturing varied from completely unfractured to, more often, highly fractured with oxidation and alteration of clay along fractures. Claystone was interbedded with the other lithologies described above, with an average thickness 1.9 m for each of the interbedded layers.

Based on regional mapping by Pana and Elgr (2013), the Brazeau thrust fault is located in the western portion of the LAA between the proposed diversion structure and the existing Highway 22 bridge; however, it was not identified in borehole or outcrop during the course of the field program. The thrust fault (reverse fault dipping less than 45°) has pushed the hanging wall block in the west over the footwall block in the east. Thrust faults in the region result in older formations being thrust over younger formations. Although the fault was not identified, steeply dipping bedding angles were noted in the western portions of the LAA compared to sub-horizontal bedding in the east. This transition may mark the approximate location of the thrust fault.

3.1.3 Basal Silt, Sand and Gravel

In some portions of the LAA, a coarser grained unit occurs above the bedrock at the base of the till. This unit is most prominent near the Elbow River Valley and consists of a mixture of brown sand, silt and gravel with variable fines. The distribution of the basal silt, sand and gravel deposits is shown in yellow in Figure 3-5.

This unit was described in outcrop along the Elbow River, as noted in the Preliminary Geotechnical Assessment Report (Stantec 2017). Outcrops were generally 0.5 to 1.0 m thick and consisted of clast-dominated diamicton. White and orange staining was noted, which indicated oxidation and mineral precipitation processes.

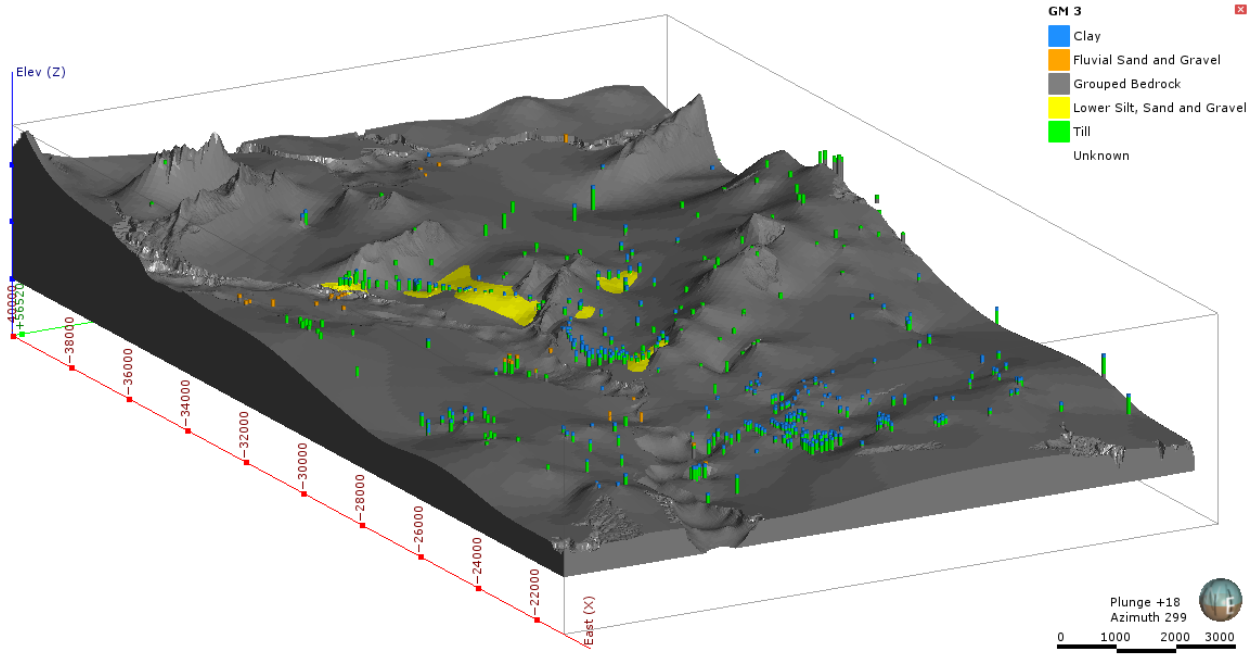


Figure 3-5 Distribution of Basal Silt, Sand and Gravel

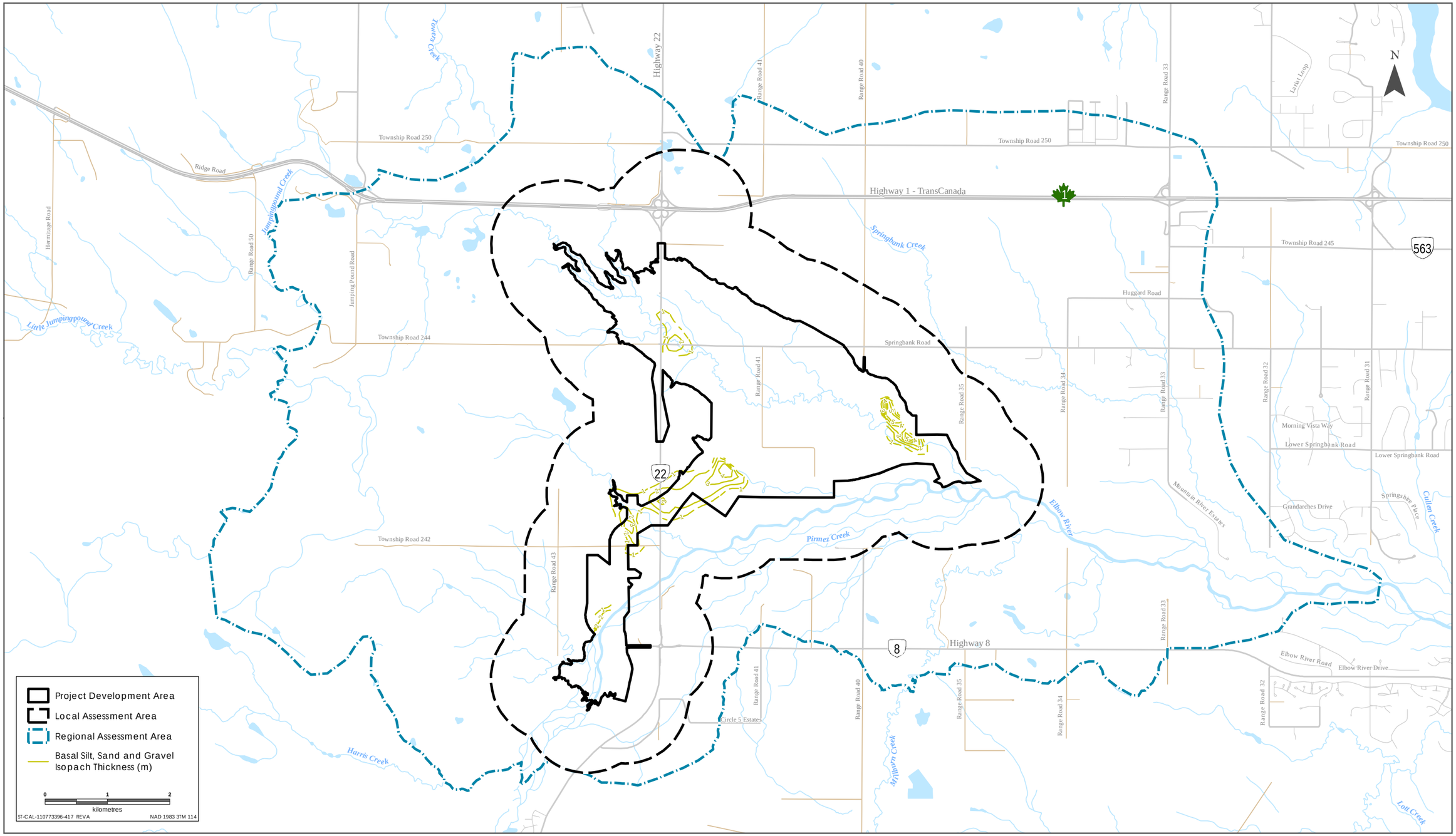
3.1.4 Till

The unconsolidated deposits present beneath the majority of the assessment area consist of Pleistocene Age glaciolacustrine clay and till (Fenton et al. 2013; Moran 1986). In the RAA, the till material was deposited by glacial ice as basal or lateral moraines. Based on the field observations and laboratory grain size analyses completed as part of the geotechnical drilling program, the till in the LAA is composed of a heterogeneous mixture of approximately equal parts clay and silt, a lower proportion of sand, and minor gravel. Silt and sand lenses are also present within the heterogeneous matrix. The till is described as generally stiff to very stiff or hard, medium to high plastic clay with silt and more minor sand.

Two main till sub-units are described in the Preliminary Geotechnical Assessment Report (Stantec 2017). These units are summarized as follows:

- **Brown-Grey Subglacial Till:** dark brown to grey sandy, silty, clay with variable gravel. The till was described as hard with low to medium plasticity. The brow-grey subglacial till was encountered throughout the dam and diversion footprint. Cobble-sized clasts within the matrix were rounded to sub-rounded sandstones and carbonates.
- **Upper Brown Till**: described as a massive, matrix-supported, olive brown to brown, medium plastic clay, clay and silt with sand content increasing with depth. This unit was encountered in boreholes in the dam footprint and eastern portion of the diversion channel.
- **Basal Silt, Sand and Gravel:** In some portions of the LAA, there is a coarser-grained unit at the base of the till. This unit is prominent near the Elbow River Valley and consists of a mixture of sand, silt and gravel. It is thought that these deposits are of preglacial or subglacial fluvial origin. The distribution of the basal silt, sand and gravel deposits are presented in yellow in Figure 3-6.

Except for the basal unit, the sub-units have not been modelled in the CSM due to their uncertain structure and because they share similar aquifer/aquitard properties.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Isopach Map of the Basal Silt, Sand and Gravel

Figure 3-6

The distribution of till across the RAA is depicted in green in Figure 3-7. Figure 3-8 presents an isopach thickness map of the till material.

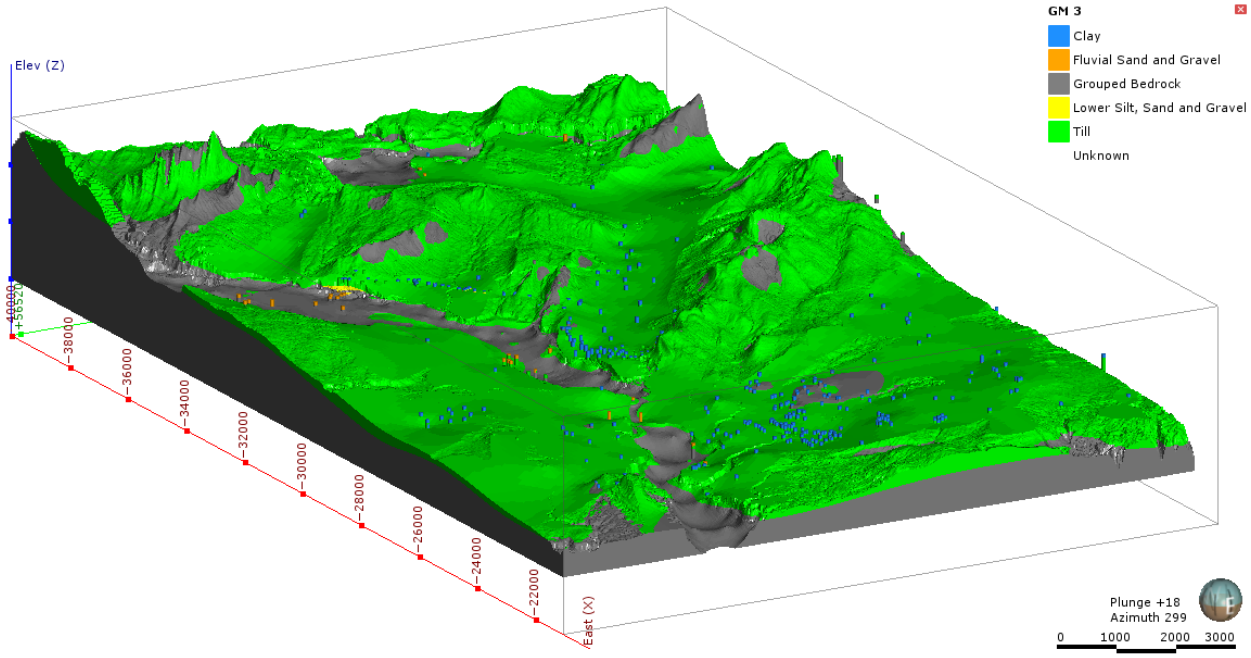

Figure 3-7 Distribution of Till

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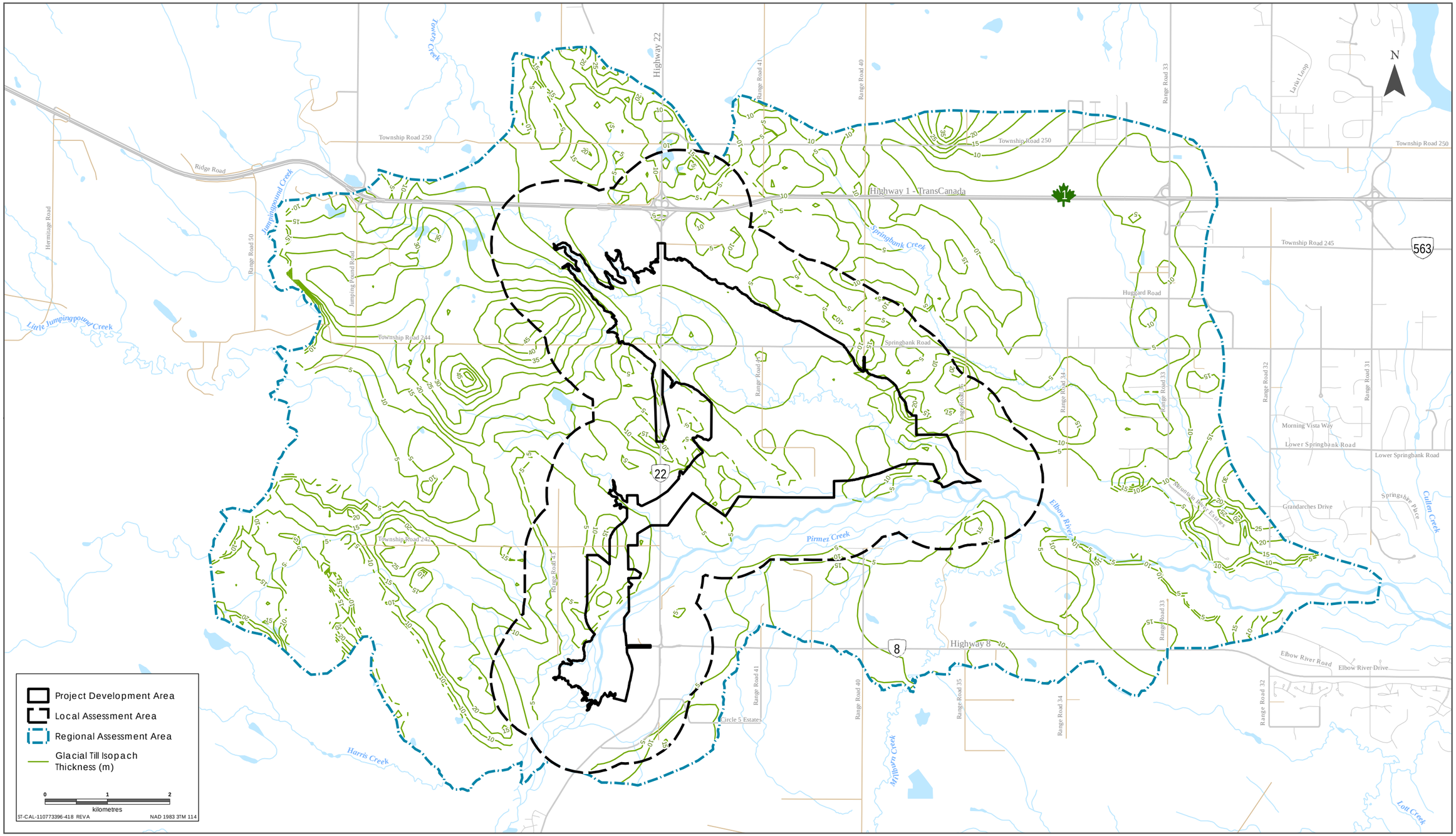

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Isopach Map of the Glacial Till

Figure 3-8

3.1.5 Glaciolacustrine Deposits

Glaciolacustrine clay overlies the till in the low-lying areas of the LAA. The silty clay was deposited in Glacial Lake Calgary, a proglacial lake formed by ice damming during the last deglaciation. The glaciolacustrine deposits are been named the Calgary Formation (Moran 1986).

The distribution of this unit is presented in blue in Figure 3-9. Figure 3-10 presents an Isopach thickness map of the glaciolacustrine unit. Within the LAA, the glaciolacustrine clay averaged 5.3 m thick in the boreholes where is was encountered.

Based on the field observations and laboratory grain size analyses, the glaciolacustrine clay in the LAA is composed of 50-70% clay, 30-40% silt and a minor proportion of sand. Typical of a lacustrine deposit, the clay was found to be laminated with silt and fine sand. This layering has resulted in relatively high hydraulic conductivities compared to the underlying till; groundwater preferentially flows through the silt. The laminations and rhythmic bedding of the glaciolacustrine deposits can be observed along the banks of the Elbow River in the RAA. Further discussion of hydraulic properties and groundwater flow is presented in Section 3.2.

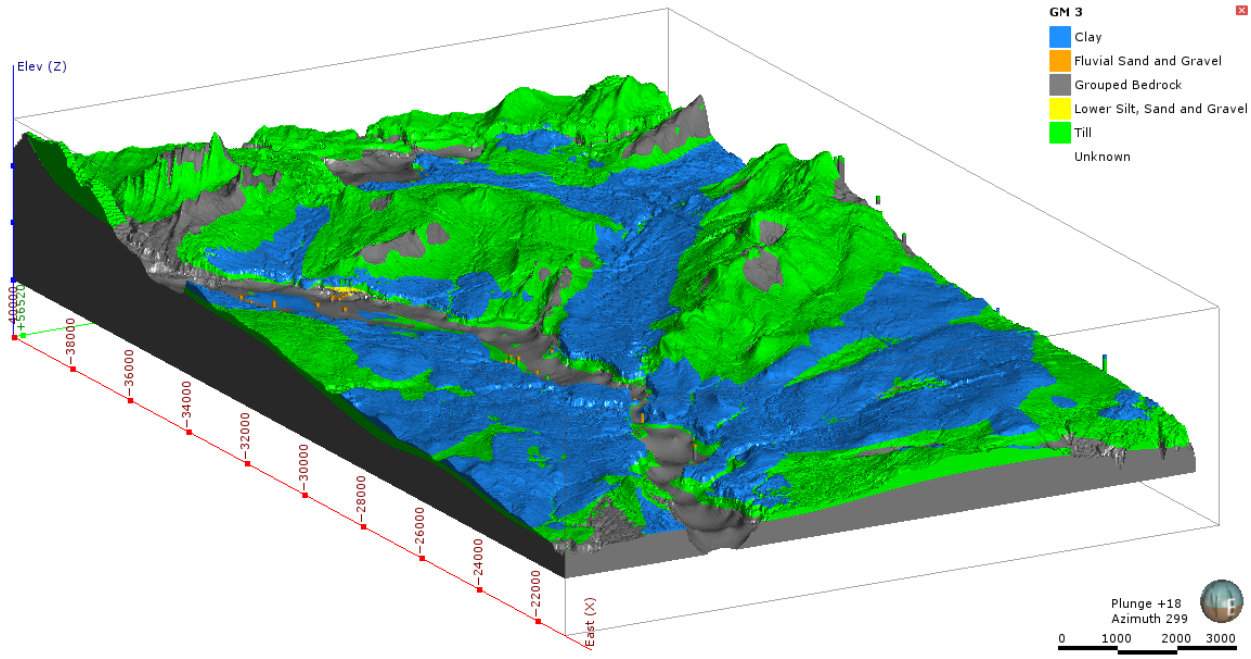

Figure 3-9 Distribution of Glaciolacustrine Deposits

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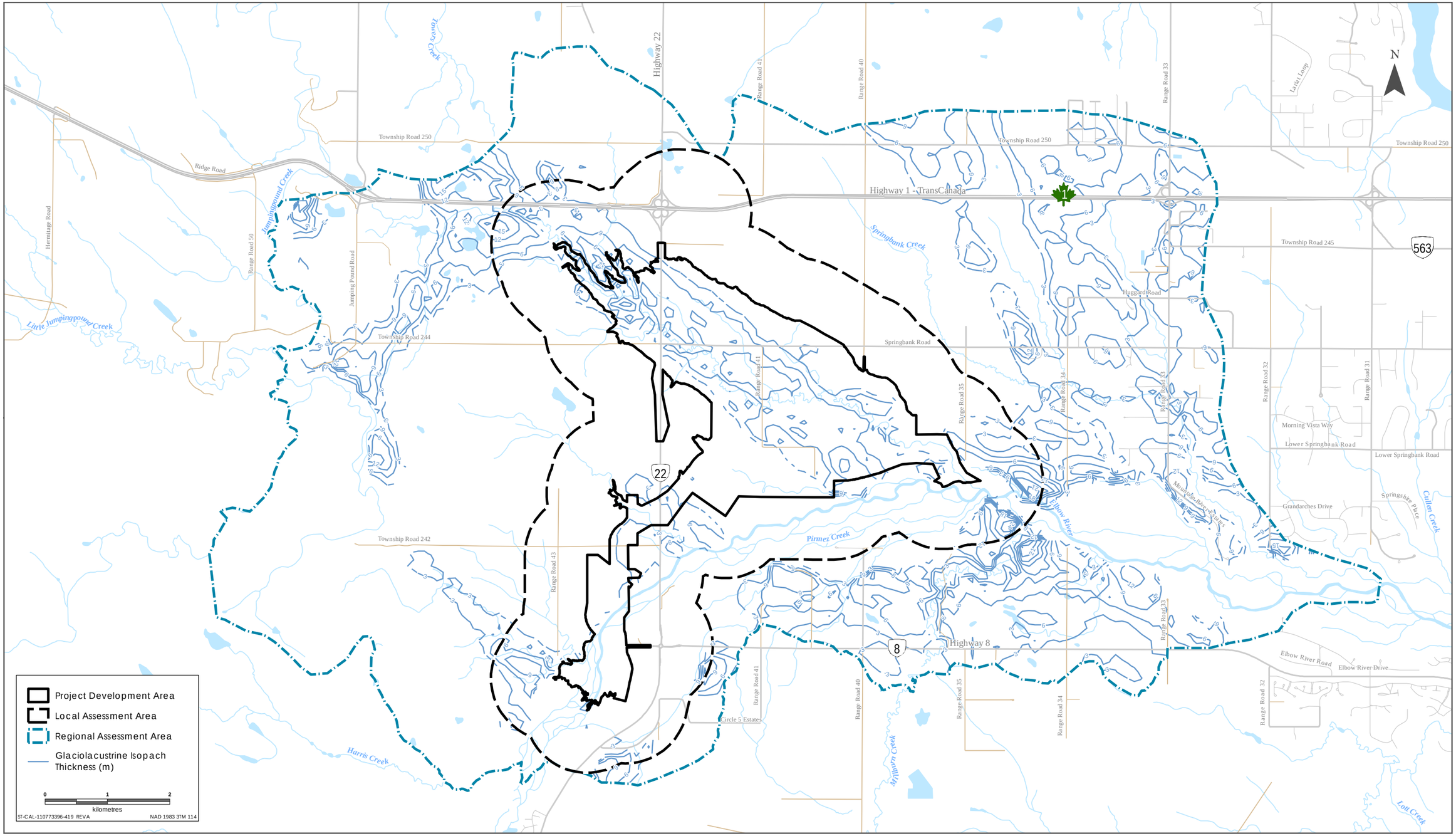

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Isopach Map of the Glaciolacustrine Deposits

Figure 3-10

3.1.6 Recent Fluvial Deposits

Post-glacial fluvial channel sediments are in the Elbow River valley in the southern part of the RAA and the Jumpingpound River in the west. These sediments developed as the rivers exported eroded material from upstream areas and deposited coarse alluvium (sand and gravel). Localized areas of overbank deposits consisting of fluvial silt are also present (Moran 1986). The deposition of alluvium over Quaternary deposits or bedrock in the valleys resulted in the formation of alluvial aquifers, which are an important source of groundwater for the river and local residents.

The alluvial aquifers provide temporary storage for water from the Elbow and Jumpingpound Rivers during floods; the water is naturally released back into the rivers after a flood ends. Groundwater from the alluvial aquifer of the Elbow River is essential in maintaining baseflow. Yields for the Elbow River alluvial aquifer range from 175 m^3/day to 2,500 m^3/day (Waterline 2011).

Recent fluvial deposits are depicted in orange in Figure 3-11, and they are described in the geotechnical logs for boreholes completed near the proposed diversion structure. The fluvial deposits in this area are brown and grey silty gravel with more minor sand, cobbles and boulders. An isopach map of the interpreted thickness of the fluvial deposits is presented in Figure 3-12.

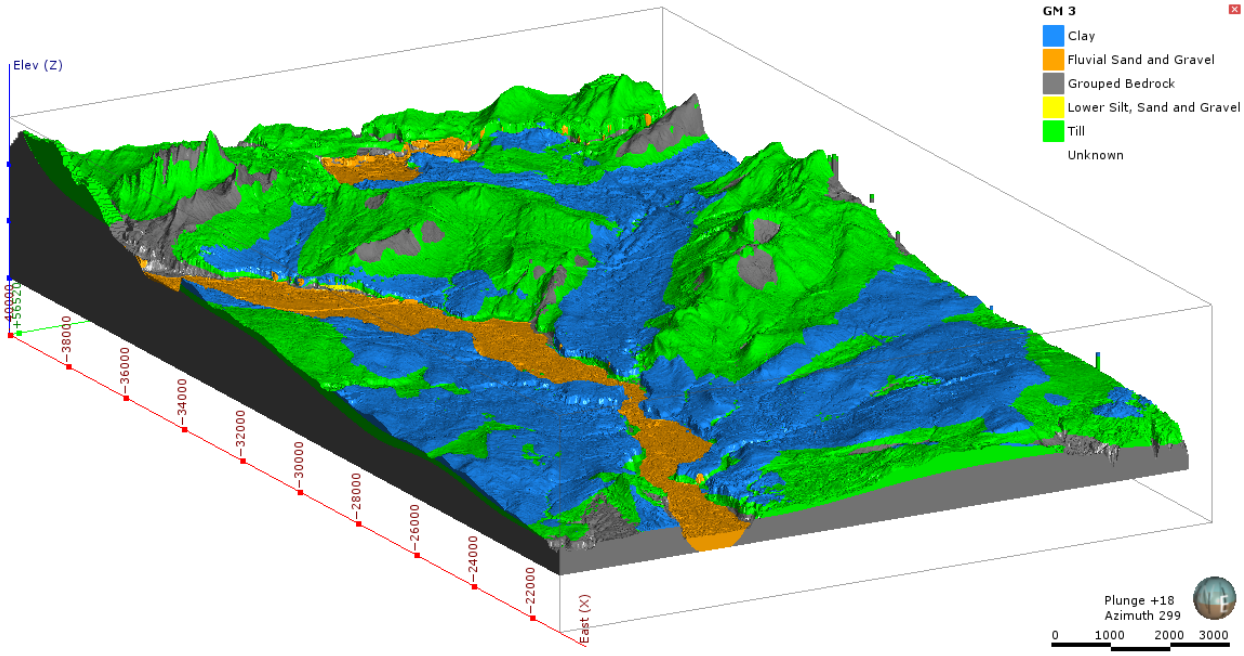

Figure 3-11 Distribution of Recent Fluvial Deposits

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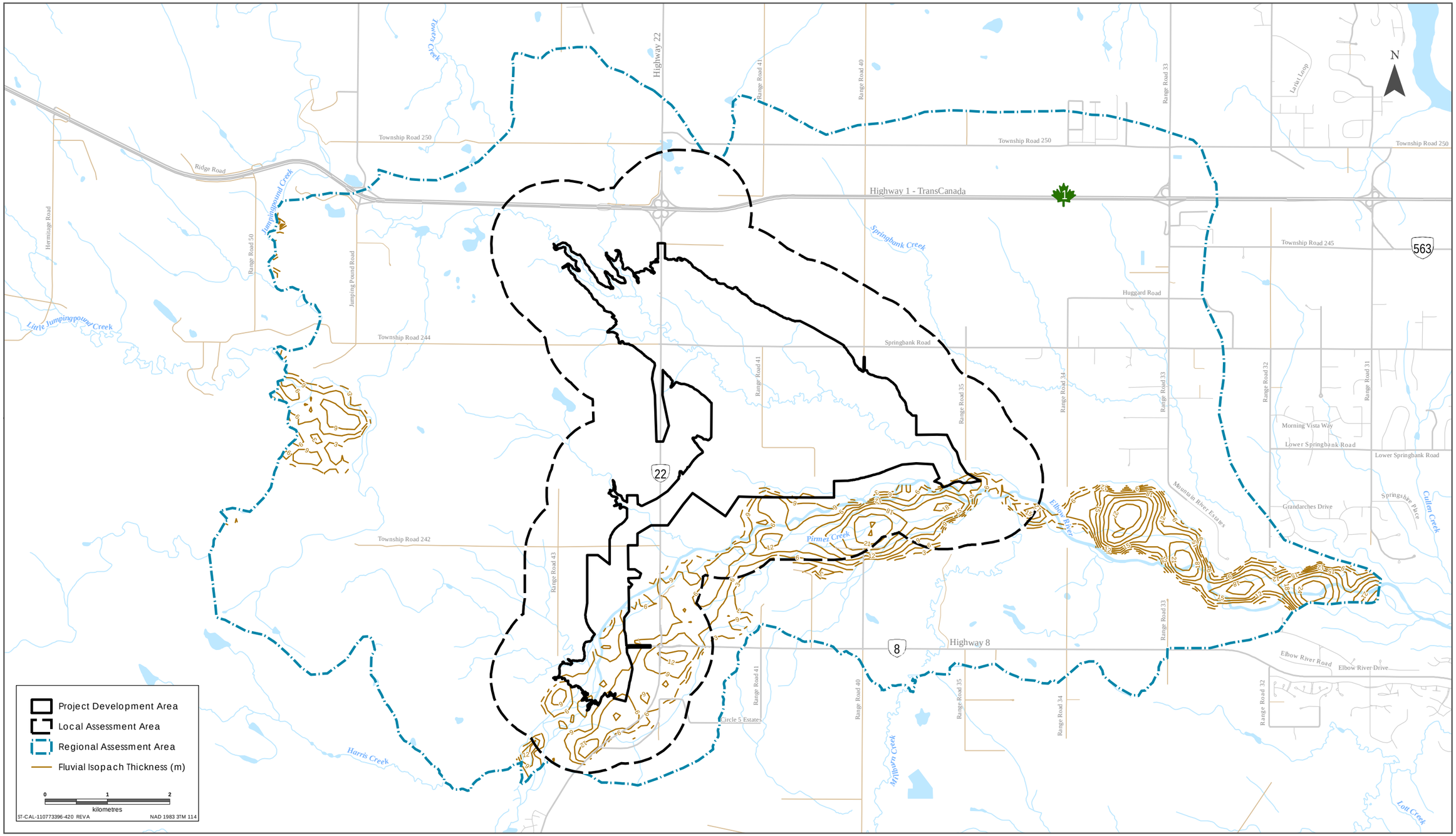

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Isopach Map of the Recent Fluvial Deposits

Figure 3-12

3.1.7 Cross-Sections

The locations of five hydrogeological cross-sections A–A' to E-E'' in the RAA are shown on Figure 3-13. The locations of the cross-sections were chosen such that A-A' to C-C' run approximately parallel to the alignment of the diversion channel and dam and D-D' and E-E' run approximately perpendicular to their alignment. The cross-section lines selected in planview were then used to create the cross-section profiles presented in Figure 3-14 to Figure 3-16.

The cross-sections cut through the entire RAA and show the major hydrostratigraphic units from ground surface to the undifferentiated bedrock. The borehole traces presented on the sections are the locations of lithological data control points. Boreholes within 300 m of each cross-section are projected onto the section.

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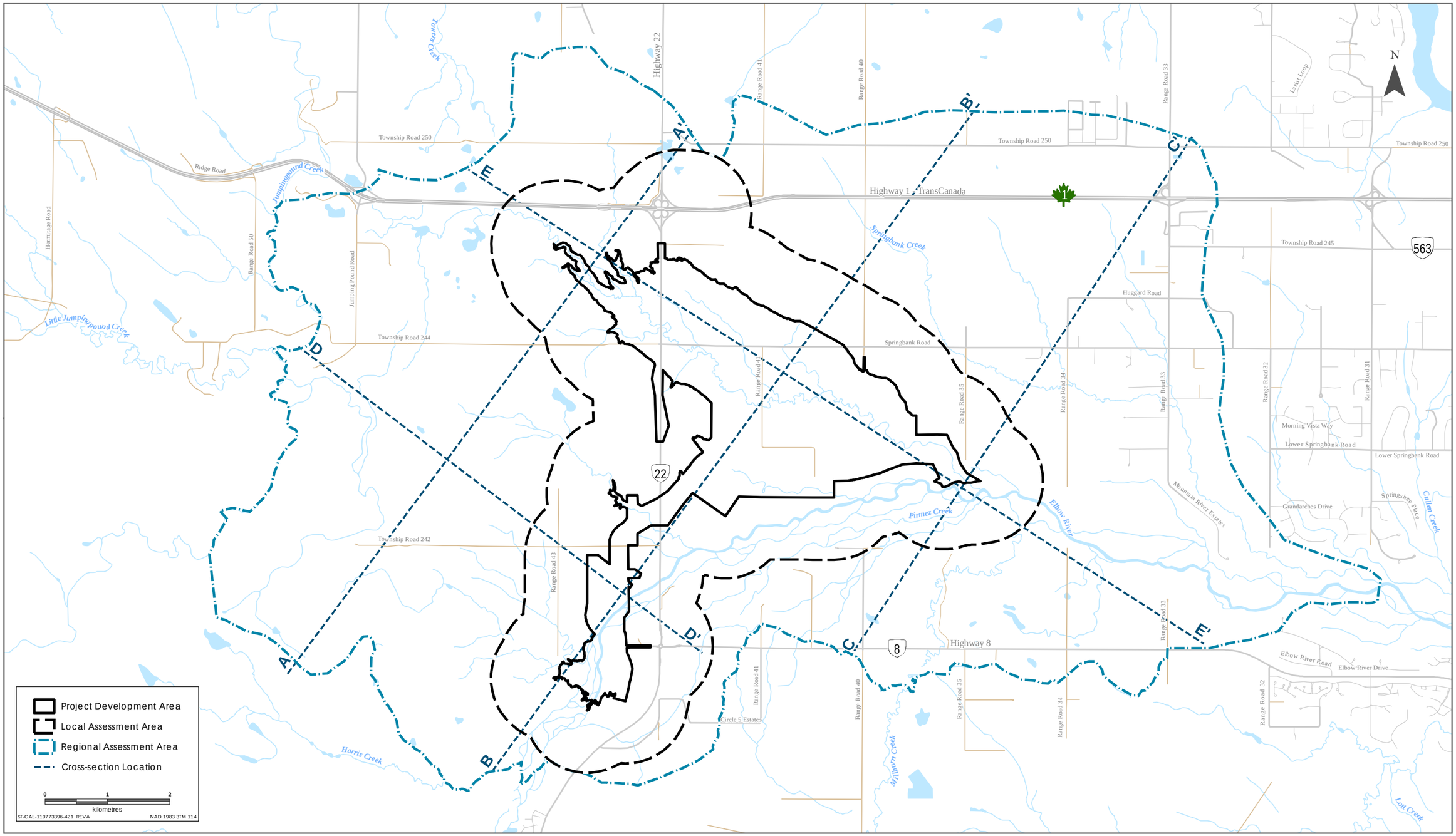

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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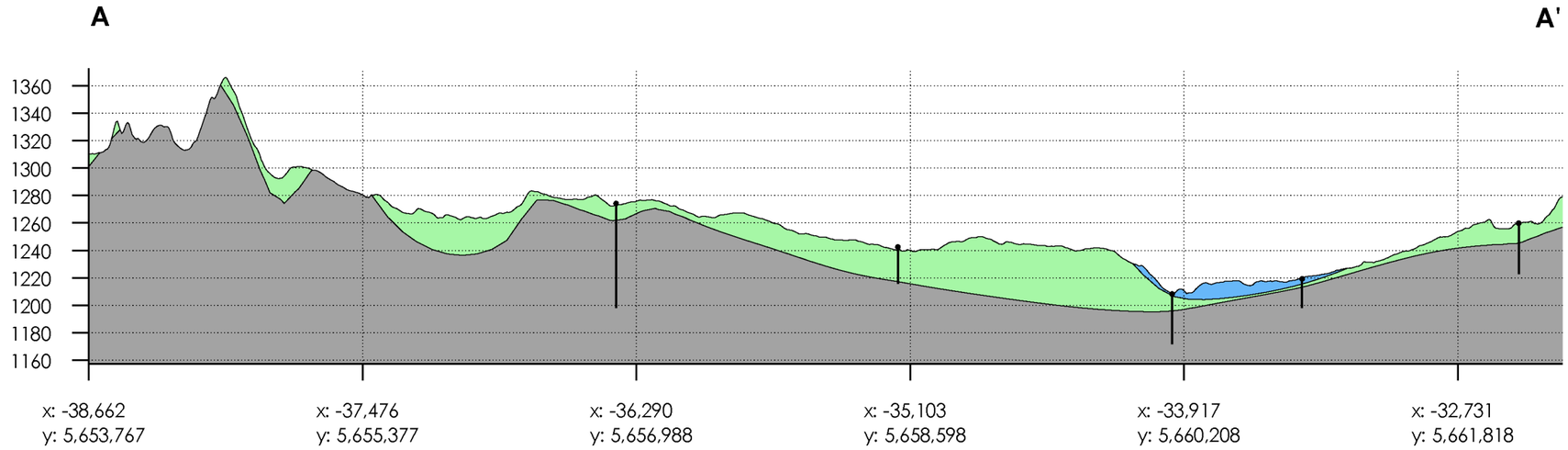
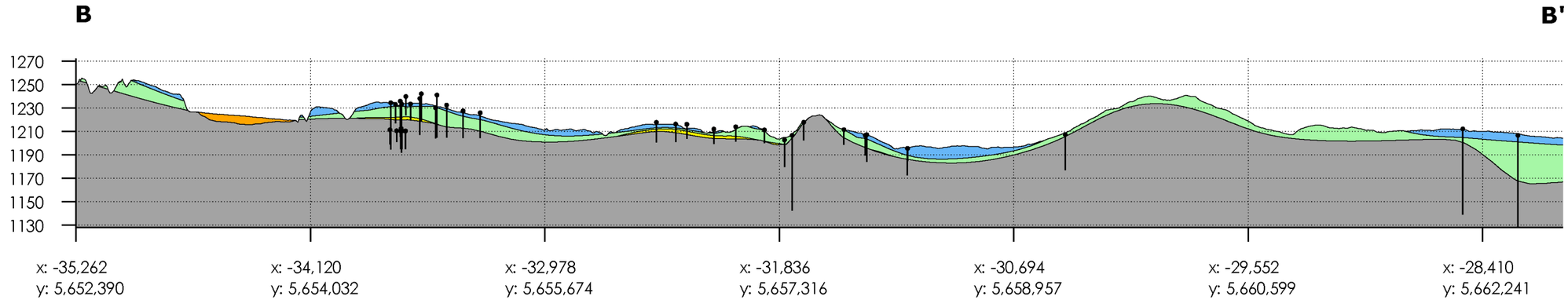
ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Hydrostratigraphic Cross-section Locations

Figure 3-13





Lithological Legend

- Glaciolacustrine Clay and Silt
- Till
- Basal Silt, Sand and Gravel
- Undifferentiated Bedrock
- Recent Fluvial Sand and Gravel
- Well/Borehole Record Projected on to Section (<300 m from section line)

Vertical Exaggeration: 10x

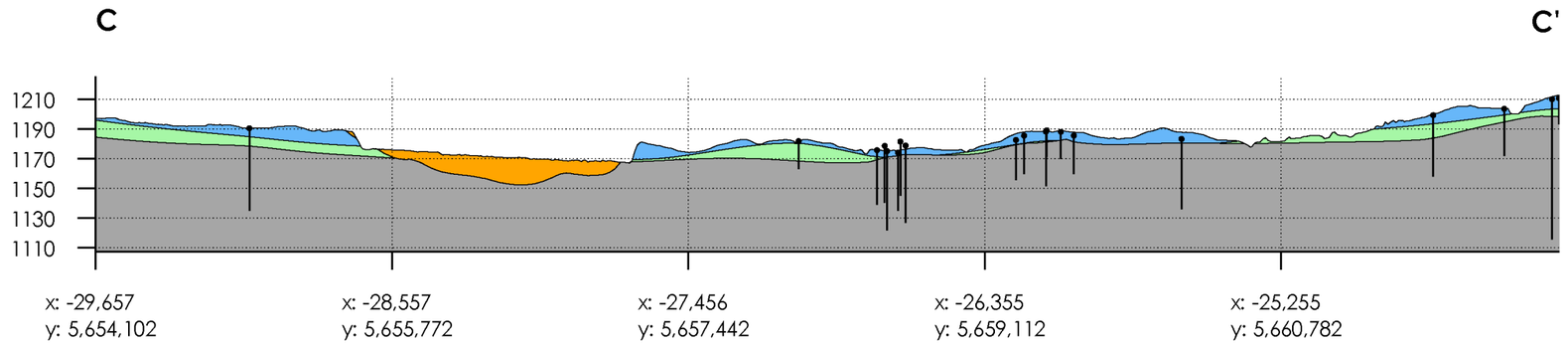
0 1,000 2,000
metres

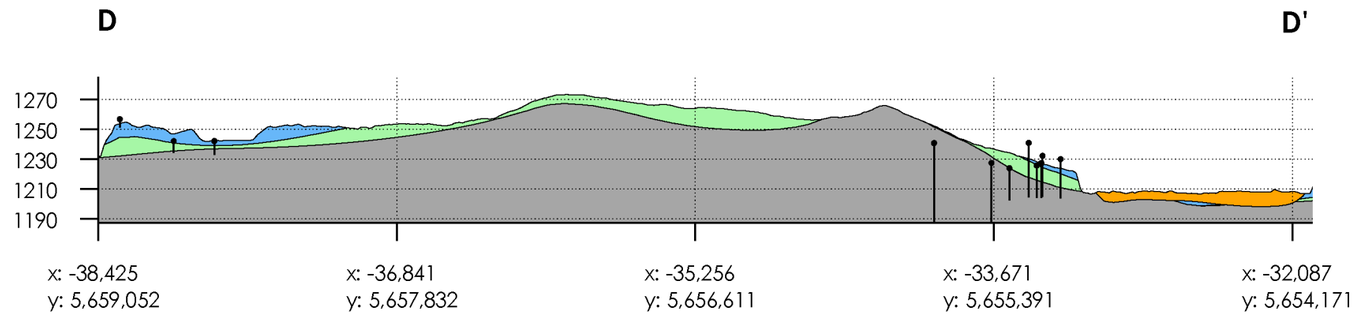
ST-CAL-110773396-424 REVA

Sources: Thematic Data - Stantec Ltd.

Cross-section of Profiles A-A' and B-B'

Figure 3-14





Lithological Legend

- Glaciolacustrine Clay and Silt
- Till
- Undifferentiated Bedrock
- Recent Fluvial Sand and Gravel
- Basal Silt, Sand and Gravel
- Well/Borehole Record Projected on to Section (<300 m from section line)

Vertical Exaggeration: 10x

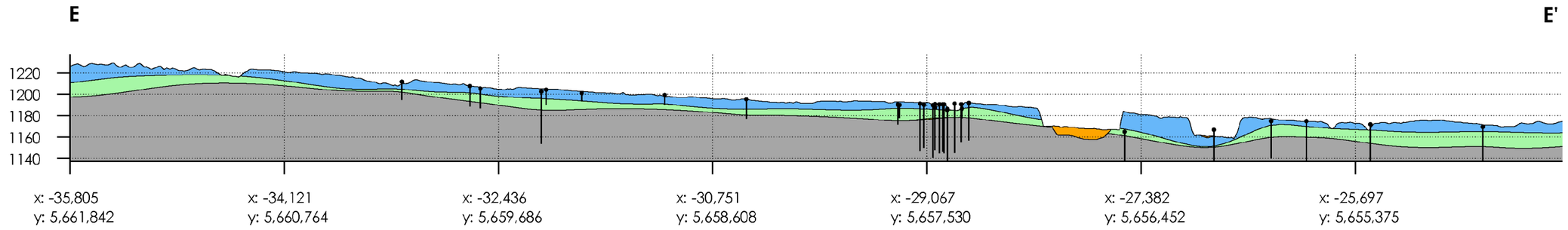
0 1,000 2,000
metres

ST-CAL-110773396-425 REVA

Sources: Thematic Data - Stantec Ltd.

Cross-section of Profiles C-C' and D-D'

Figure 3-15



Lithological Legend

- Glaciolacustrine Clay and Silt
- Till
- Basal Silt, Sand and Gravel
- Undifferentiated Bedrock
- Recent Fluvial Sand and Gravel

Well/Borehole Record Projected on to Section (<300 m from section line)

Vertical Exaggeration: 10x

0 1,000 2,000
metres

ST-CAL-110773396-426 REVA

Sources: Thematic Data - Stantec Ltd.

Cross-section of Profile E-E'

Figure 3-16

3.2 GROUNDWATER LEVELS AND FLOW REGIMES

Potentiometric surfaces were developed though geostatistical interpolation of water level measurements obtained during the fall 2016 groundwater monitoring program (see Section 2.5) along with water levels from the AWWID and surface water elevations of waterbodies within the RAA, based on LiDAR data. Further discussion of the methods used to create the potentiometric surfaces is presented in Section 2.6.

3.2.1 Hydraulic Conductivity

The hydraulic conductivity values of the material adjacent to the monitoring well completion intervals were based on the results of the single well response tests. The test results were interpreted using a combination of methods depending on the characteristics of the aquifer or aquitard and the response curves generated. Methods used included Hvorslev (1951), Bouwer and Rice (1976), and the Kansas Geological Survey (KGS) model (Hyder et al. 1994). The response test analyses are presented in Attachment A. A summary of the hydraulic conductivity estimates is presented in Table 3-1.

Table 3-1 Single Well Response Test Hydraulic Conductivity Estimates

Well Name	Completion Depth (m BGL)	Completion Lithology	Estimated Hydraulic Conductivity (m/s)		
			Hvorslev (1951)	KGS (Hyder et. al. 1994)	Bouwer-Rice (1976)
MW16-1-15	15.2	Sandstone	1.2E-06	2.3E-06	
MW16-4-22	21.6	Sandstone	8.8E-07	1.9E-06	
MW16-6-20	21.9	Claystone/Siltstone	2.8E-09	3.8E-09	
MW16-8-19	18.6	Sandstone	6.3E-07	2.2E-06	
MW16-9-6	5.8	Glaciolacustrine clay and silt	5.3E-08	2.2E-07	
MW16-10-15	15.2	Till	2.5E-10	6.3E-10	
MW16-18-10	10.6	Claystone	4.2E-06	9.6E-06	
MW16-19-19	18.6	Sandstone	3.1E-06	9.2E-06	
MW16-24-30	30.5	Sandstone	1.5E-05		
MW16-25-9	9.1	Till	2.4E-10		8.2E-10

Based on the single well response tests, the hydraulic conductivity of the unconsolidated deposits ranged from $2.4x10^{-10}$ m/s in the till to $2.2x10^{-7}$ m/s in the clay and silt of the glaciolacustrine deposits. Hydraulic conductivity estimates in the bedrock monitoring wells ranged from $2.8x10^{-9}$ m/s in the siltstone and claystone to $1.5x10^{-5}$ m/s in the sandstone. The

geometric mean hydraulic conductivity of the response tests completed in the bedrock wells (using the Hvorslev (1951) analysis) was 8.7×10^{-7} m/s.

The results of the 37 single-packer permeability tests completed as part of the geotechnical field investigation program are summarized in Table 3-2. The hydraulic conductivites estimated from the packer testing ranged from 6.1×10^{-8} m/s to 6.5×10^{-5} m/s, with a geometric mean value of 1.2×10^{-6} m/s.

Table 3-2 Single Packer Permeability Test Hydraulic Conductivity Estimates

Borehole Name	Packer Test Depth (m BGL)	Completion Lithology	Estimated Hydraulic Conductivity (m/s)
D29	21.7-24.7	claystone/siltstone	2.6E-07
	24.7-27.7	claystone/sandstone	6.1E-08
	27.2-30.2	claystone/siltstone/ Sandstone	1.1E-07
	30.7-33.7	claystone/siltstone	1.9E-07
	33.7-36.7	claystone/sandstone	2.5E-07
	36.7-39.7	claystone/sandstone	8.2E-08
	39.7-42.7	sandstone/claystone	4.1E-07
D35	14.2-17.2	sandstone/claystone	6.5E-05
	17.2-20.2	siltstone/claystone	3.8E-06
	20.2-23.2	claystone/siltstone	6.4E-07
	23.2-26.2	siltstone/claystone	2.1E-06
	26.2-29.2	sandstone	9.0E-06
	29.2-32.2	sandstone/claystone	9.0E-06
	32.2-35.2	siltstone	4.2E-06
	35.2-38.2	claystone/siltstone	2.2E-07
	38.2-41.2	siltstone/sandstone	1.3E-06
	41.2-44.2	sandstone/siltstone	1.4E-07
D38	15.2-18.2	siltstone/claystone	4.3E-05
	18.7-21.7	claystone	3.0E-07
	21.7-24.7	siltstone/claystone	3.2E-06
	24.7-27.7	claystone/sandstone	4.5E-07
	27.7-30.7	siltstone/claystone	1.9E-06
	30.7-33.7	sandstone	2.3E-06
	33.7-36.7	sandstone	2.8E-05
	36.7-39.7	siltstone/sandstone	4.9E-06
	39.7-42.7	siltstone/claystone	1.5E-06
	42.7-45.7	siltstone/claystone	3.8E-07
D51	24.7-27.7	siltstone/claystone	3.2E-06
	27.7-30.8	claystone/sandstone	2.8E-06
D60	21.6-23.1	sandstone	3.1E-07
	23.1-26.2	claystone/sandstone	1.8E-06
	26.2-29.2	claystone	1.4E-07
	29.2-32.3	claystone/sandstone	2.4E-06
	32.3-35.3	claystone/sandstone	8.6E-06
	35.3-38.4	claystone/sandstone	3.8E-07
	42.1-45.1	claystone/sandstone	3.5E-07

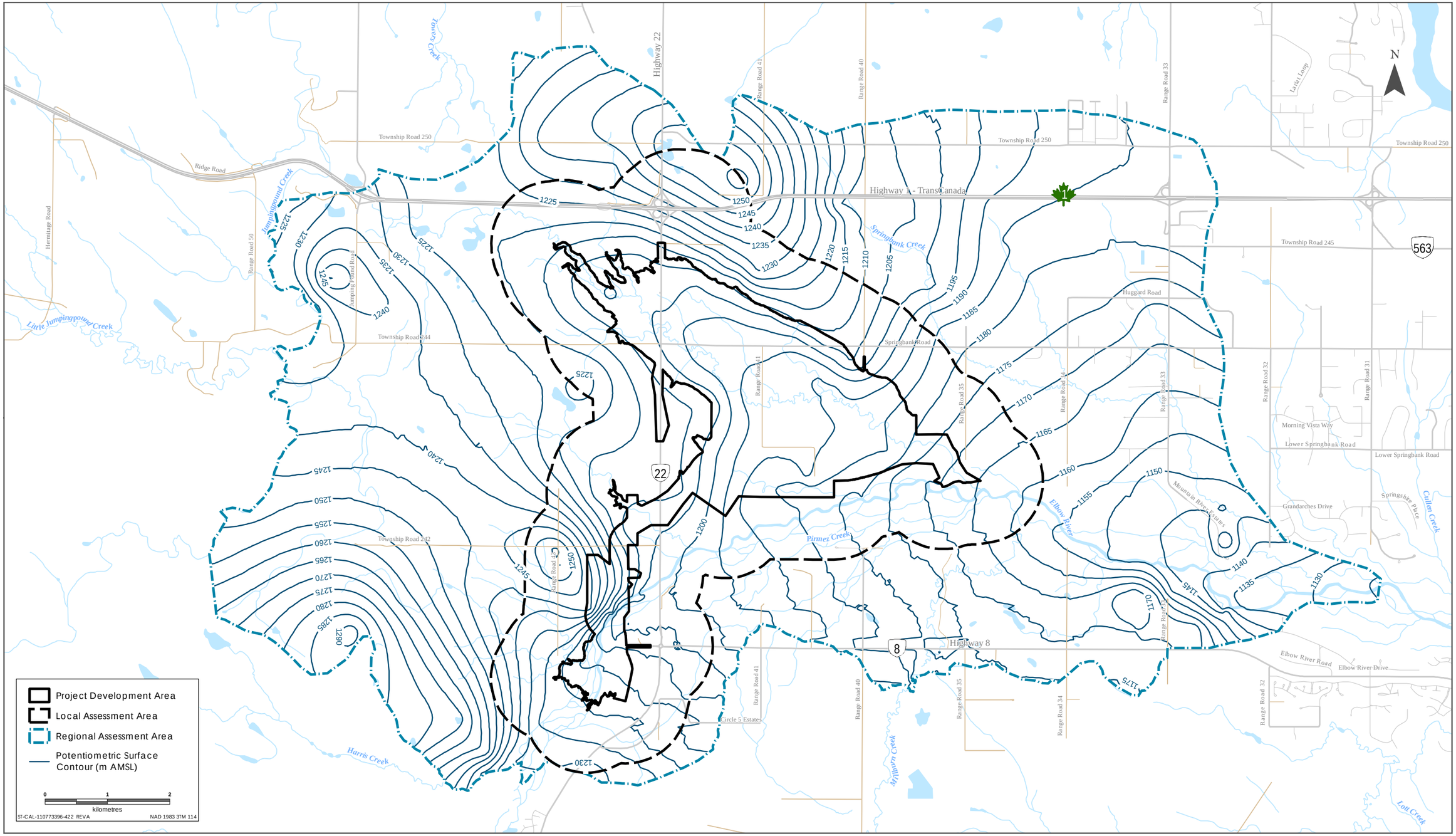
3.2.2 Groundwater Flow in the Unconsolidated Glacial Deposits

The potentiometric surface of the unconsolidated surficial aquifer is presented in Figure 3-17. Groundwater elevations within the surficial aquifer generally follow the topography and range from 0 m BGL, where the water table intersects ground surface at springs and along stream and river banks, to approximately 8.0 m BGL as measured in May 2017. The corresponding groundwater elevations range from approximately 1,290 m ASL in the southwest to 1,125 m ASL along the eastern boundary of the RAA.

Groundwater flow direction is interpreted to be toward Elbow River across the majority of the RAA, except for areas in the 1) northwest where shallow groundwater flows west toward Jumpingpound Creek, 2) areas along the north side of the RAA across the flow divide, and 3) in the Bow River watershed where groundwater flows north. Horizontal gradients beneath the LAA range from 0.003 in the central portion of the proposed reservoir to 0.1 in the southern portion of the LAA adjacent to the Elbow River near the diversion structure.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT
HYDROGEOLOGY BASELINE TECHNICAL DATA REPORT

Results
March 2018



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Potentiometric Surface of the Unconsolidated Deposits

Figure 3-17

A number of springs were noted along the northeast side of the off-stream reservoir area (red), as indicated in blue in Figure 3-18. Based on the drilling program, these springs were interpreted to be contact springs with groundwater flow in the unconsolidated deposits discharging where the underlying low permeability bedrock material is near surface along the valley wall. As groundwater flows along this contact, downward flow is limited and the water discharges along the slope forming the springs. The elevation of these springs ranges from approximately 1,205 m ASL in the southeast to 1,225 m ASL further northwest along the valley wall. At least one contact spring was also identified along the southwest valley wall of the off-stream reservoir. This spring location is plotted in Figure 3-18 and is at an elevation of approximately 1,211 m ASL. Further downslope from the contact springs, gravity springs also occur where the potentiometric surface intersects the ground surface.

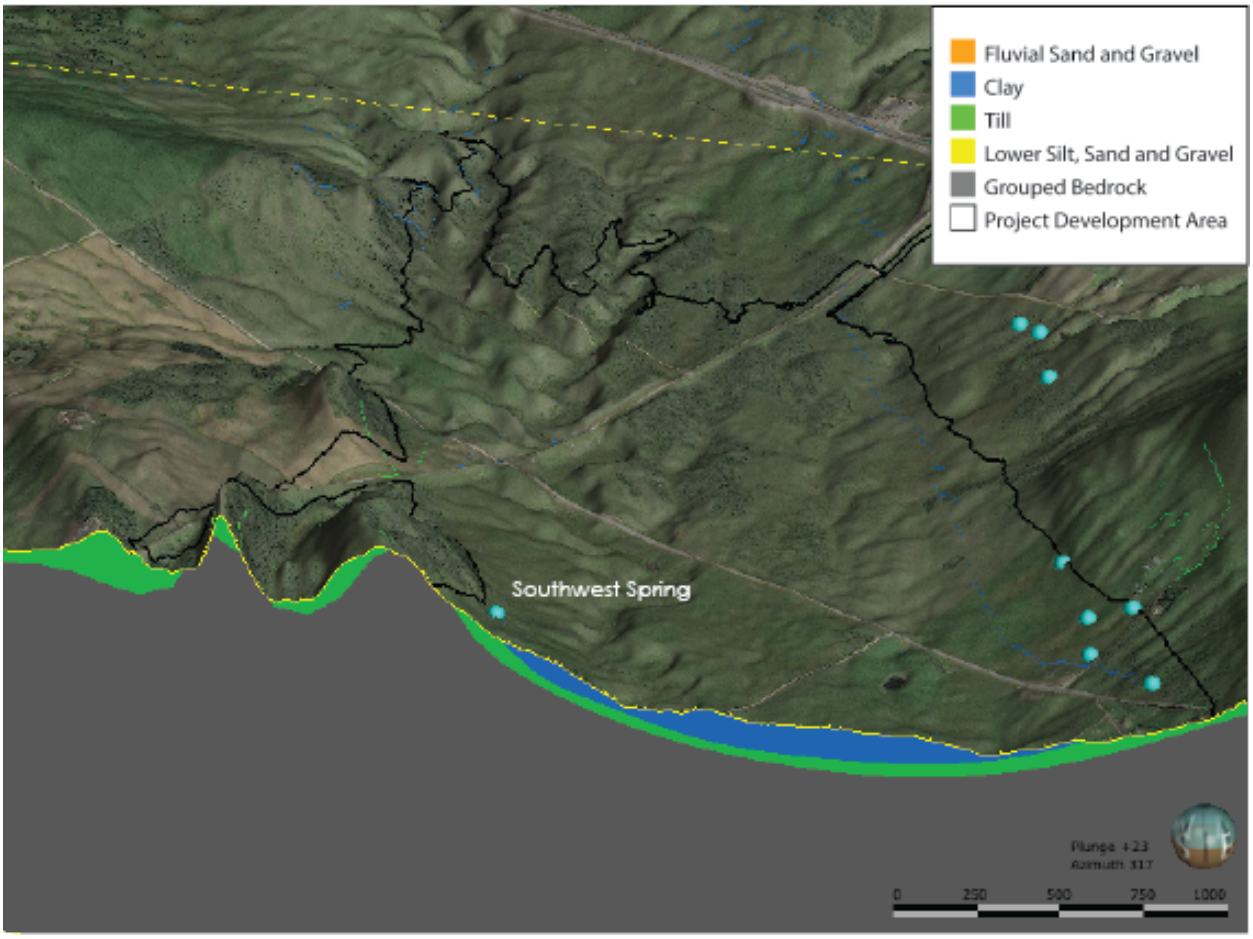


Figure 3-18 Spring Locations

Average linear groundwater velocities have been estimated based on the hydraulic conductivities and apparent horizontal hydraulic gradients described above:

$$V = Ki/n$$

where: V is the average linear velocity (m/yr)
K is the hydraulic conductivity (0.01 to 6.9 m/yr in the unconsolidated glacial deposits);
i is the estimated hydraulic gradient (0.003 to 0.1)
n is the assumed effective porosity of 0.3.

The average linear groundwater velocity in the unconsolidated glaciolacustrine and till is estimated to range from less than .01 m/y to approximately 2.3 m/y. However, it should be noted that flow velocities through sand lenses within, or at the base of, the till could be higher.

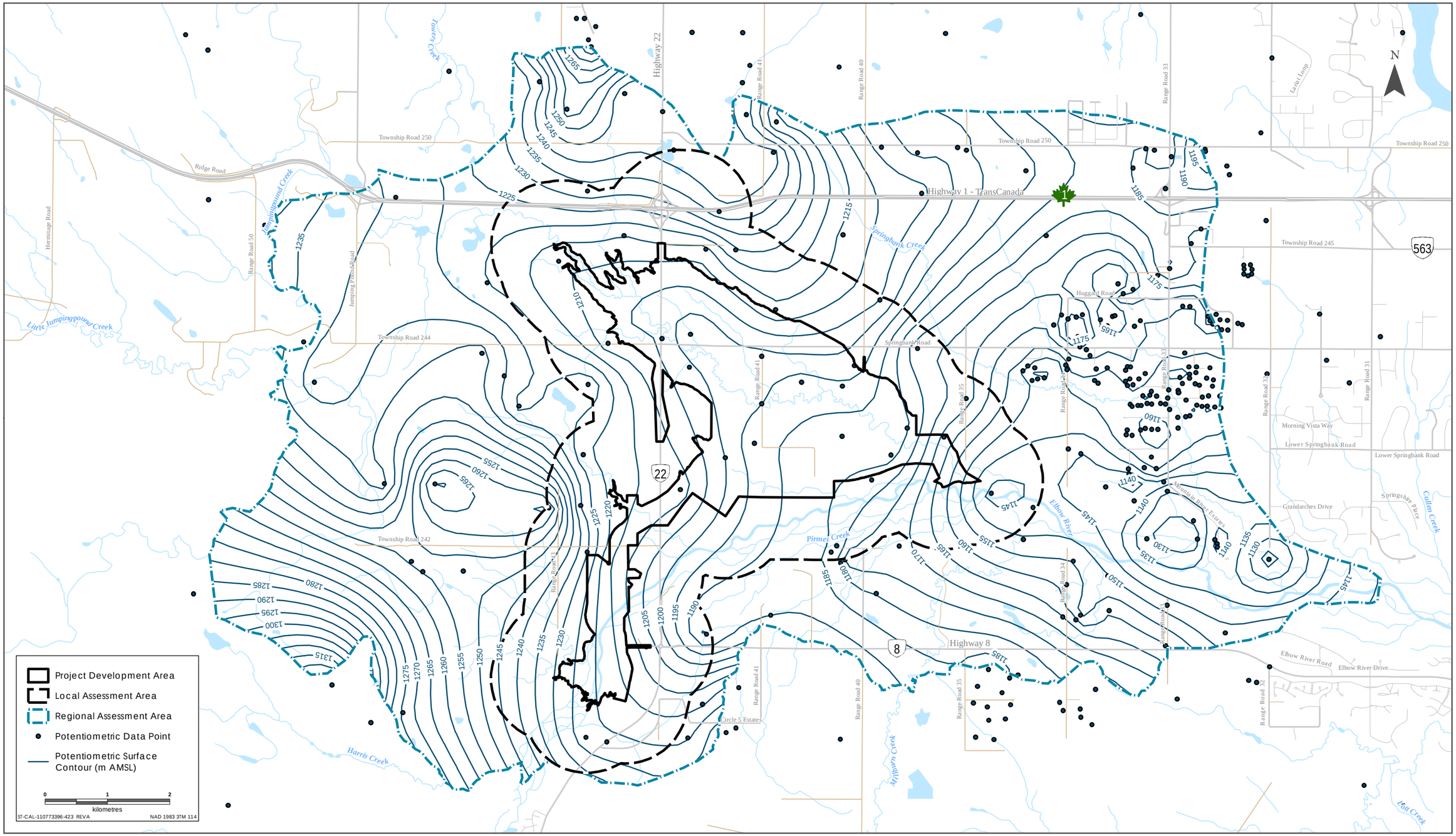
3.2.3 Groundwater Flow in the Upper Bedrock Aquifers

The potentiometric surface of the bedrock aquifer is presented in Figure 3-19. The hydraulic head data points used in the interpretation are also presented in the figure. Potentiometric surface elevations range from approximately 1,300 m ASL in the southwest to 1,123 m ASL along the eastern boundary of the RAA.

Groundwater flow direction in the bedrock is toward the Elbow River across the majority of the RAA. Groundwater elevations within the upper bedrock generally follow the topography although the relationship is not as strong as compared to the potentiometric surface of the unconsolidated deposits, as expected. Horizontal gradients in the upper bedrock aquifers beneath the LAA range from 0.005 in the central portion of the proposed reservoir to 0.02 in the southern portion of the LAA adjacent to the Elbow River near the diversion structure.

The average linear groundwater velocity in the shallow bedrock is estimated to range from less than .01 cm/y in the unfractured portions of the claystone bedrock to approximately 30 m/yr in the more permeable sandstone in the areas of higher hydraulic gradient near the Elbow River.

Yields calculated by HCL (2002) for wells completed in the bedrock aquifers in the disturbed belt in this area generally ranged from 10 m^3/day to 75 m^3/day.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Potentiometric Surface of the Upper Bedrock

Figure 3-19

3.2.4 Vertical Hydraulic Gradients

Vertical hydraulic gradients between the unconsolidated and bedrock deposits indicate the potential for upward-directed groundwater flow (discharge) at each of the four nested monitoring well locations. The vertical gradients ranged from 0.1 at MW16-6-11/MW16-6-20 to 1.9 at MW16-8-8/MW16-8-19.

In addition to the contact springs discussed in Section 3.2.2, the relatively high magnitude vertical gradients likely result in artesian springs along the valley walls and in low-lying areas where the confining layers are thin or in areas of more permeable material.

3.2.5 Groundwater Level Fluctuation

Groundwater levels fluctuate in response to various climatic and anthropogenic influences. Short-term fluctuations result from precipitation, seasonal effects (e.g., spring runoff, dry periods, frozen surface water etc.) or transient groundwater pumping. Longer term fluctuations are generally caused by climatic trends (e.g., prolonged drought or successive years of above normal precipitation) or groundwater production.

Hydrographs depicting change in groundwater levels over time have been prepared for 10 monitoring wells within the RAA. The data for the hydrographs was recorded using data logging pressure transducers installed in each of the wells and covers the period between October 7, 2016 and May 24, 2017. Hydrographs for monitoring wells completed in the unconsolidated materials above bedrock are presented in Figure 3-20 and the hydrographs of wells completed in bedrock, and generally to greater depths, are presented in Figure 3-21 and Figure 3-22.

Water levels in the wells completed in the unconsolidated deposits generally showed the same seasonal trends (Figure 3-20), except for monitoring well MW16-17-5. The very low hydraulic conductivity adjacent to the screened interval of MW16-17-5 masks the effects of the natural variation. Following purging during the September 2016 monitoring, the water level slowly recovered toward a static level and continued recovering until February 16, 2017. An increase of approximately 1 m was observed over a one-hour period on February 16. Given the warm temperature of 16°C, the increase is attributed to a loss of surface seal integrity (either the cap or well seal) and meltwater entering the well. Because the water level in the well was then artificially high, the level decreased toward static over the period of February to May, 2017.

The water level elevations in the remaining three monitoring wells completed in unconsolidated deposits increased or remained stable between October 2016 and December 2016. Water levels then decreased over the winter months reaching seasonal lows in March to April 2017. Water level increases were then observed during April and May. Water level fluctuations were less than 0.5 m in the three monitoring wells.

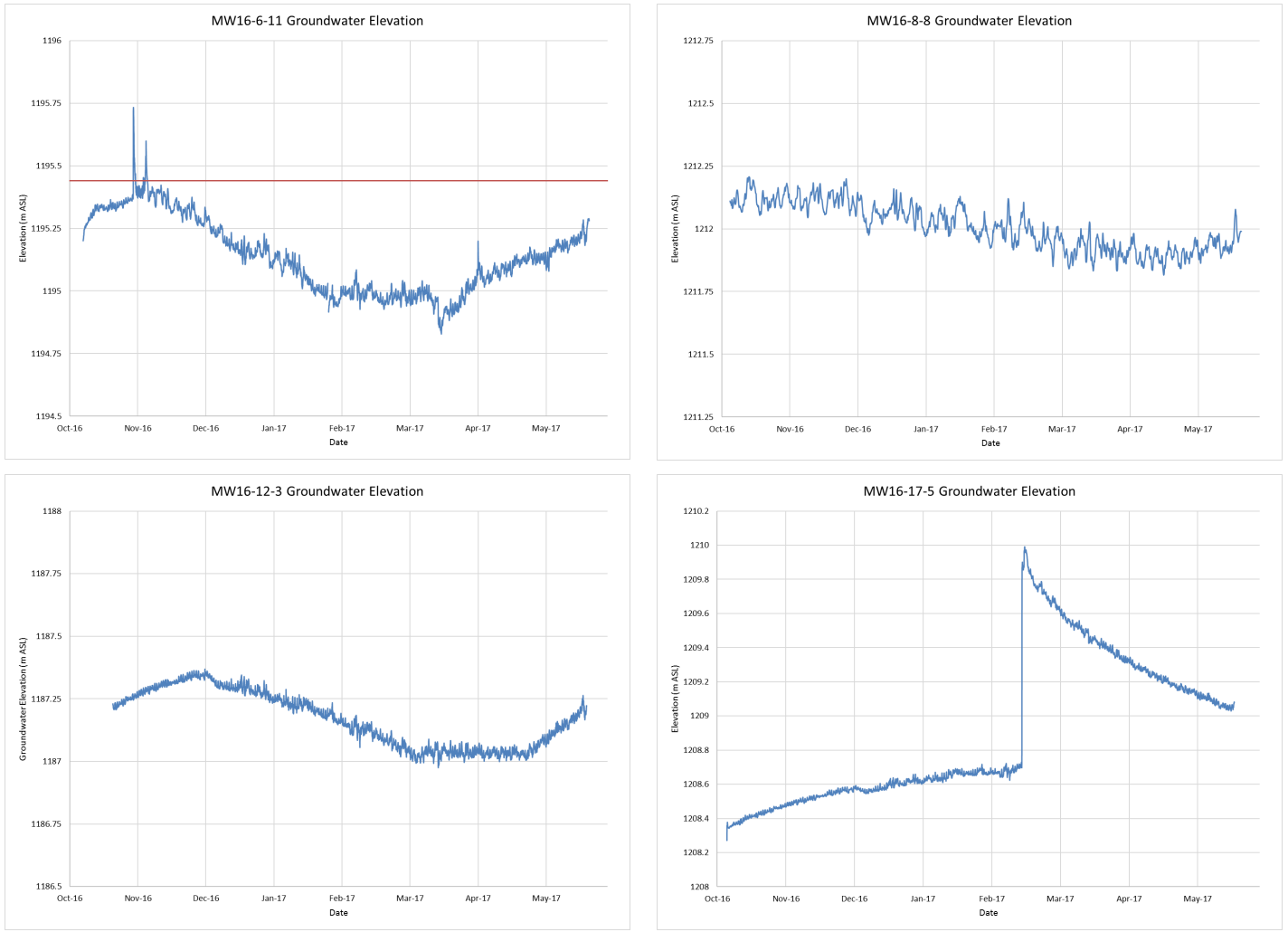


Figure 3-20 Hydrographs of Monitoring Wells Completed in Unconsolidated Deposits

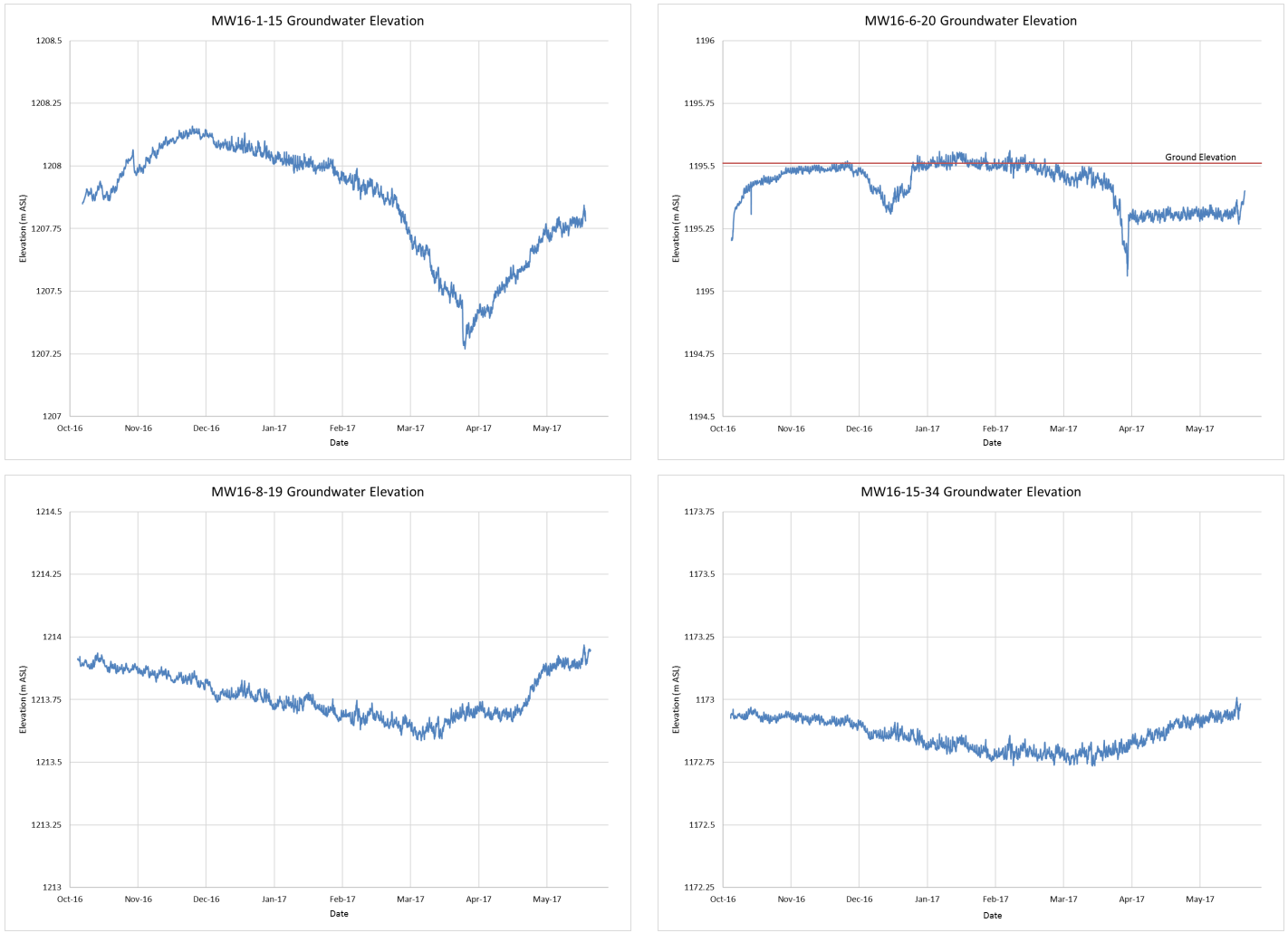


Figure 3-21 Hydrographs of Well Completed in Bedrock

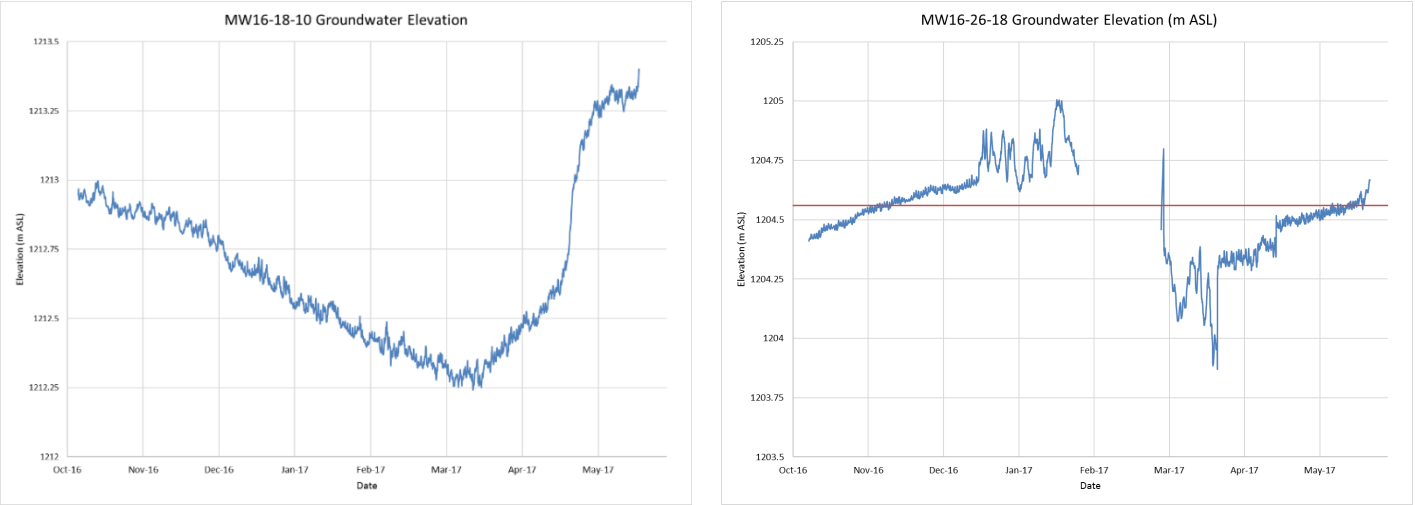


Figure 3-22 Hydrographs of Well Completed in Bedrock (continuation of Figure 3.21)

Water levels, or potentiometric elevations in the case of confined portions of the bedrock aquifers, exhibited seasonal trends similar to the unconsolidated deposits in a number of monitoring wells. In four of the six bedrock wells monitored, levels decreased between October 2016 and late March 2017 and then increased between late March to May 2017. However, MW16-6-20 had water levels that were at or near the ground surface throughout the year. In monitoring well MW16-26-18, the water level was also near or above the ground surface. As a result, freezing of the water within the casing and integrity issues caused some issues with the logger readings over the winter months. Water level fluctuations of up to 2 m were observed in the bedrock monitoring wells.

Over the long-term, regional scale groundwater levels at three Alberta Environment Groundwater Observation Well Network (GOWN) wells located in the Calgary area were evaluated. Hydrographs depicting historical water levels at the three GOWN wells are presented in Figure 3-23. The Canmore well (05BEG018) shows seasonal variability as a result of being installed in an unconfined fluvial aquifer. Water levels increased each spring, reaching a peak in June, and followed by a steady decrease over the remainder of the year and into the next spring. Water level fluctuations fluctuate by approximately 3 m over this annual cycle. The fluctuations are related to river levels; this well is in direct hydraulic connection with the Bow River. Similar fluctuations would be expected in wells completed in the recent fluvial deposits near Elbow River.

The GOWN well at Crossfield ((05BHG006) shows considerably less variation than the Canmore well. The Crossfield well is completed to approximately 48 m BGL in interbedded shale and sandstone bedrock. Fluctuations of approximately 0.5 m are observed at this well over the 2009 to 2017 monitoring record with fluctuations independent of seasonal effects. No long-term trends are evident that this well.

At the Okotoks GOWN well (05BLG006), completed in sandstone to 38 m BGL, a relatively high degree of variation in water levels is noted along with an overall increasing trend. The water level in this well increased from a depth of approximately 31 m in 1986 to less than 27 m in 2016.

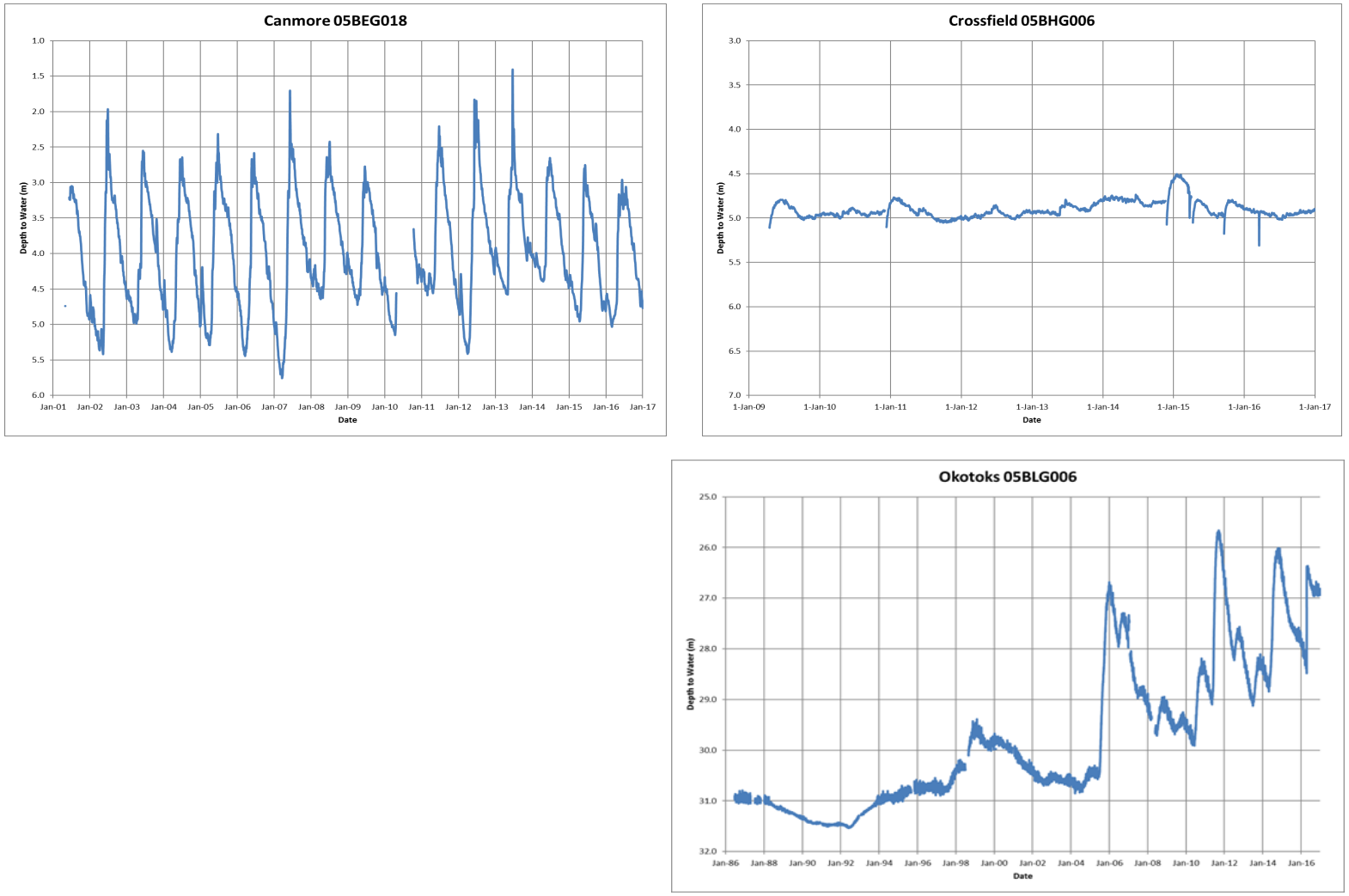


Figure 3-23 GOWN Well Hydrographs

3.3 GROUNDWATER USE

Groundwater use in the RAA is primarily from shallow bedrock aquifers with some wells also completed in the recent fluvial deposits along the Elbow River. Regional mapping by HCL (2002) indicated yields from the bedrock aquifers in the disturbed belt range from 10 m^3/day to 75 m^3/day. Yields from wells completed in the recent fluvial deposits along the Elbow River are expected to range from 175 m^3/day to 2,500 m^3/day (Waterline 2011).

The base of groundwater protection (BGP) is an estimate of the elevation of the base of the geological formation in which the groundwater is deemed useable with a total dissolved solids (TDS) concentration of less than 4,000 mg/L. West of the RAA, the BGP is defined as the base of the Paskapoo Formation; however, because the RAA lies within the disturbed belt of the Rocky Mountains, the AGS has set an arbitrary BGP of 600 m BGL.

Water well drillers records for groundwater wells completed in the RAA were queried from the AWWID. A total of 594 unique well records were identified within the RAA. A number of well record types were removed from the raw data such as abandoned test holes, dry holes, piezometers, chemistry only records, and seismic test holes, which are not reflective of groundwater use.

A total of 392 water well drilling records remained after removing irrelevant data. A summary of water well records is presented as additional information in Attachment B. A domestic water well testing program was completed, as requested by landowners, within the LAA. Wells that were verified in the field and monitored as part of the program are indicated in Attachment B. The proposed use of the wells associated with these drilling records were the following:

- 277 for domestic use
- 50 for stock use
- 31 for domestic and stock use
- 7 for industrial purposes
- 2 for irrigation purposes
- 5 for municipal use
- 20 for unknown use

Water well depths ranged from 5 m to 200 m BGL. Figure 3-24 presents a histogram of the total depth recorded on the drilling records.

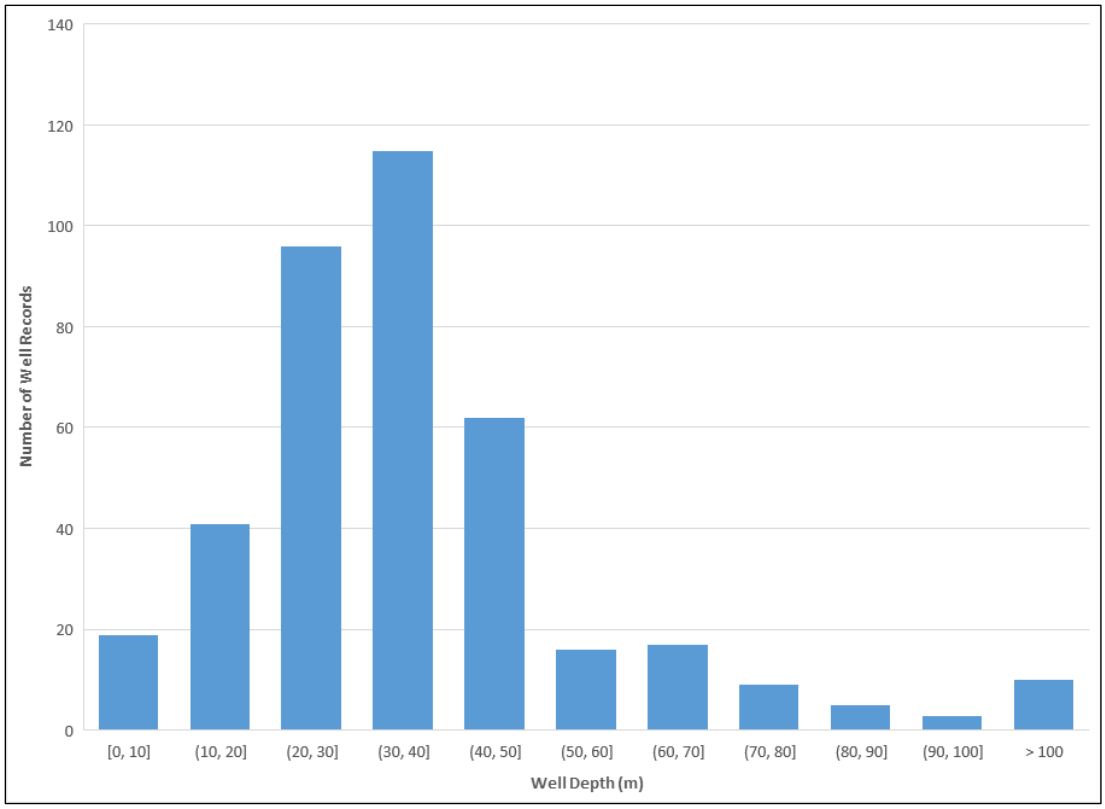


Figure 3-24 Histogram of Water Well Depth in the RAA

Groundwater diversion licences and registrations associated with the water well records in the RAA provide additional information on the nature and magnitude of water use. Table 3-3 summarizes the licenses and registrations.

Table 3-3 Groundwater Licences and Registrations in the RAA

Legal Land Description (Section)	Authorization	License or Registration Number	Water Source	Maximum Diversion (m^3/year)
18-024-04-W5	Registration	00161483-00-00		6,250
19-024-04-W5	License	00027534-00-00	Groundwater	14,548
19-024-04-W5	Registration	00161324-00-00		6,250
30-024-04-W5	Registration	00159661-00-00		6,250
30-024-04-W5	Registration	00172207-00-00		6,250
29-024-04-W5	License	00027539-00-00	Groundwater	909
29-024-04-W5	Registration	00161324-00-00		6,250

Table 3-3 Groundwater Licences and Registrations in the RAA

Legal Land Description (Section)	Authorization	License or Registration Number	Water Source	Maximum Diversion (m^3/year)
20-024-04-W5	Registration	00161324-00-00		6,250
08-024-04-W5	Registration	00161483-00-00		6,250
05-024-04-W5	Registration	00174068-00-00		6,250
33-024-04-W5	License	00027538-00-00	Groundwater	909
33-024-04-W5	Registration	00161324-00-00		6,250
28-024-04-W5	License	00027529-00-00	Groundwater	2,273
28-024-04-W5	License	00027536-00-00	Groundwater	909
21-024-04-W5	License	00027530-00-00	Groundwater	2,728
21-024-04-W5	License	00027532-00-00	Groundwater	1,364
21-024-04-W5	License	00027533-00-00	Groundwater	1,364
21-024-04-W5	License	00027537-00-00	Groundwater	1,818
03-025-04-W5	Registration	00161384-00-00		6,250
03-025-04-W5	Registration	00182509-00-00		6,250
34-024-04-W5	Registration	00170103-00-01		6,250
27-024-04-W5	License	00027701-00-00	Groundwater	1,364
27-024-04-W5	Registration	00183452-00-00		6,250
22-024-04-W5	Registration	00163401-00-00		6,250
15-024-04-W5	Registration	00159911-00-00		6,250
15-024-04-W5	Registration	00162017-00-00		6,250
15-024-04-W5	Registration	00163401-00-00		6,250
10-024-04-W5	License	00025968-00-01		6,250
03-024-04-W5	License	00042981-00-00	Surface Water	1,480,176
03-024-04-W5	Registration	00155886-00-00		6,250
03-024-04-W5	Registration	00163271-00-00		6,250
03-024-04-W5	Registration	00172847-00-00		6,250
35-024-04-W5	License	00024023-00-00	Groundwater	6,365
26-024-04-W5	License	00027702-00-00	Groundwater	1,364
26-024-04-W5	Registration	00163271-00-00		6,250
23-024-04-W5	Registration	00161619-00-00		6,250
23-024-04-W5	Registration	00163401-00-00		6,250
01-025-04-W5	License	00032202-00-00	Surface Water	2,467

Table 3-3 Groundwater Licences and Registrations in the RAA

Legal Land Description (Section)	Authorization	License or Registration Number	Water Source	Maximum Diversion (m^3/year)
01-025-04-W5	Registration	00161570-00-00		6,250
36-024-04-W5	Registration	00078333-00-00		6,250
25-024-04-W5	License	00027704-00-00	Groundwater	2,728
25-024-04-W5	License	00027705-00-00	Groundwater	3,637
25-024-04-W5	Registration	00163271-00-00		6,250
24-024-04-W5	License	00027703-00-00	Groundwater	3,637
24-024-04-W5	Registration	00163116-00-00		6,250
12-024-04-W5	Registration	00169793-00-00		6,250
12-024-04-W5	License	00308955-00-00	Surface Water	123,348
06-025-03-W5	License	00024545-00-00	Groundwater	2,273
06-025-03-W5	Registration	00167951-00-00		6,250
30-024-03-W5	License	00036667-00-00	Surface Water	16,035
30-024-03-W5	License	00040206-00-00	Surface Water	3,700
30-024-03-W5	Registration	00160646-00-00		6,250
19-024-03-W5	Registration	00161652-00-00		6,250
19-024-03-W5	Registration	00161875-00-00		6,250
19-024-03-W5	Registration	00333125-00-00	Groundwater	970
19-024-03-W5	Registration	00333126-00-00	Groundwater	835
05-025-03-W5	Registration	00202163-00-00		6,250
32-024-03-W5	License	00032320-00-00	Unknown	
29-024-03-W5	Registration	00161634-00-00		6,250
20-024-03-W5	License	00031829-00-00	Unknown	
20-024-03-W5	Registration	00161660-00-00		6,250
20-024-03-W5	Registration	00333125-00-00	Groundwater	970
17-024-03-W5	License	00157105-01-00	Surface Water	311,642
17-024-03-W5	Registration	00160591-00-00		6,250
08-024-03-W5	Registration	00160591-00-00		6,250
33-024-03-W5	Registration	00082946-00-00		6,250
28-024-03-W5	License	00023993-00-00	Groundwater	21,367
28-024-03-W5	License	00029356-00-00	Surface Water	11,101
28-024-03-W5	License	00032318-00-00	Groundwater	12,729

Table 3-3 Groundwater Licences and Registrations in the RAA

Legal Land Description (Section)	Authorization	License or Registration Number	Water Source	Maximum Diversion (m^3/year)
28-024-03-W5	License	00033554-00-00	Groundwater	2,273
28-024-03-W5	License	00034624-00-00	Surface Water	9,868
16-024-03-W5	Registration	00075112-00-00		6,250
16-024-03-W5	License	00158951-00-00	Surface Water	191,190
09-024-03-W5	License	00029362-00-00	Surface Water	10,361
09-024-03-W5	License	00034481-00-00	Surface Water	7,400
34-024-03-W5	License	00024328-00-00	Groundwater	2,273
34-024-03-W5	Registration	00141013-00-00		6,250
11-024-03-W5	License	00031035-00-00	Surface Water	2,467

3.4 GROUNDWATER CHEMISTRY

Groundwater chemistry within the assessment area was established using data from the groundwater monitoring described in Section 2.5. All monitoring wells were sampled with the exception of MW16-13-37, which could not be located and may have been destroyed. The full analytical suite of parameters described in Section 2.5 was analyzed for each monitoring well sampled except for MW16-12-3 and MW16-17-5 where, as a result of low yield, microbiological and hydrocarbon parameters were not analyzed. Additional analytical data from the domestic well testing program were also included in the discussion of existing water chemistry. Table 3-4 presents the laboratory analytical results from project-specific monitoring, and the analytical results from the domestic well testing program are summarized in Table 3-5. Analytical data from the third party domestic well testing program are not included in this summary.

For comparison purposes, Table 3-4 includes the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Alberta Tier 1 Guidelines) (AEP 2016) for fine grained soils in an agricultural land use setting and the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2014).

Figure 3-25 presents a diagram to visually represent the TDS and major ion chemistry of the groundwater samples collected from monitoring wells in the LAA. The size of the symbols in the central portion of the piper diagram are scaled to represent the relative TDS concentration of the sample. TDS in all samples ranged from 440 mg/L to 6,900 mg/L. The water chemistry characteristics displayed in the diagram are described in the following sections.

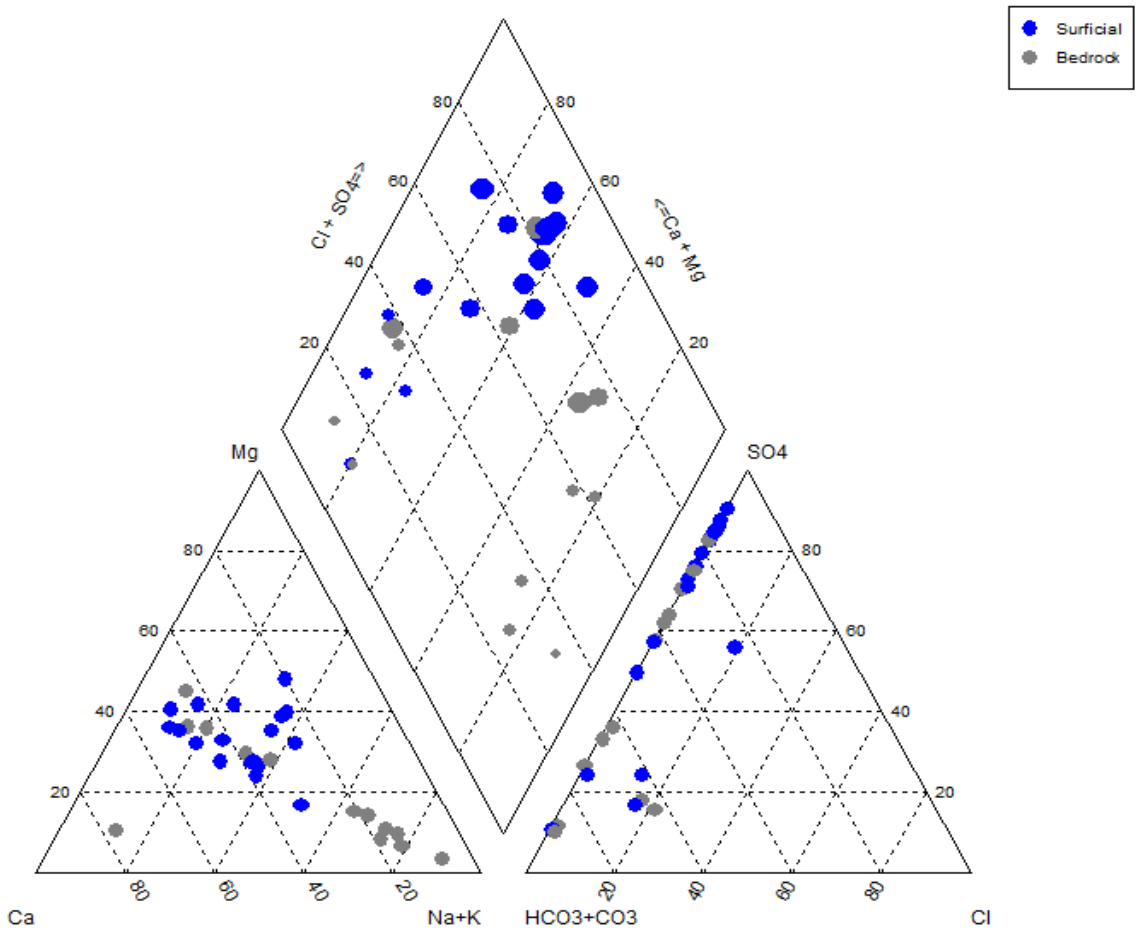


Figure 3-25 Diagram of Monitoring Well Chemistry

Table 3-4
Water Quality Analytical Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters
Springbank SR1 Well Survey

Sample Location				MW16-2-6	MW16-3-7	MW16-6-11	MW16-7-5	MW16-8-8	MW16-9-6	MW16-10-15	MW16-11-15	MW16-12-3	MW16-16-11	MW16-17-5	MW16-18-6	MW16-19-8	MW16-22-26	MW16-23-14	MW16-25-9
Sample Date				**30-Sep-16**	**28-Sep-16**	**27-Sep-16**	**27-Sep-16**	**4-Oct-16**	**30-Sep-16**	**4-Oct-16**	**30-Sep-16**	**6-Oct-16**	**3-Oct-16**	**6-Oct-16**	**4-Oct-16**	**27-Sep-16**	**28-Sep-16**	**29-Sep-16**	**30-Sep-16**
Aquifer				Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
Lithology				Sandstone	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glacial Till	Glacial Till	Glacial Till	Glaciolacustrine Clay	Basal Silt and Sand	Basal Silt and Sand	Glacial Till	Glacial Till	Glacial Till
	Units	**Health Canada**	**AEP**																
Calculated Parameters																			
Anion Sum	meq/L	n/v	n/v	83	32	43	55	12	21	45	39	33	78	110	13	32	26	13	13
Cation Sum	meq/L	n/v	n/v	83	33	41	49	12	22	42	38	31	75	100	12	31	26	14	14
Hardness (as CaCO3)	mg/L	n/v	n/v	2600	950	1300	1600	550	930	1400	1200	1300	2400	3500	480	980	640	540	590
Ion Balance	none	n/v	n/v	1.0	1.0	0.95	0.90	1.0	1.1	0.94	0.98	0.94	0.95	0.93	0.98	0.96	1.0	1.0	1.1
Nitrate	mg/L	45[C]	13[D]	<0.22	1.3	<0.044	<0.044	6.9	0.065	0.12	<0.044	1.5	0.14	5.0	5.3	1.8	0.054	<0.044	0.064
Nitrate + Nitrite (as N)	mg/L	n/v	100[D]	0.024	0.30	<0.020	<0.020	1.6	<0.020	0.027	<0.020	0.34	0.031	1.3	1.2	0.42	<0.020	<0.020	<0.020
Nitrite	mg/L	3[C]	0.06[D]	**0.078[D]**	0.051	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	**0.55[D]**	**0.10[D]**	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	≤500[B]	500[D]	**5300[BD]**	**2000[BD]**	**2700[BD]**	**3400[BD]**	**640[BD]**	**1200[BD]**	**2800[BD]**	**2400[BD]**	**1900[BD]**	**4900[BD]**	**6900[BD]**	**650[BD]**	**2000[BD]**	**1700[BD]**	**680[BD]**	**680[BD]**
BTEX and Petroleum Hydrocarbons																			
Benzene	mg/L	0.005[C]	0.005[D]	0.00044	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	-	**0.0056[CD]**	-	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024[B] 0.06[C]	0.024[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	-	0.024	-	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016[B] 0.14[C]	0.0016[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	-	**0.0034[BD]**	-	0.00062	<0.00040	<0.00040	<0.00040	<0.00040
Xylene, m & p-	mg/L	n/v	n/v	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	-	0.013	-	0.0020	<0.00080	<0.00080	<0.00080	<0.00080
Xylene, o-	mg/L	n/v	$_{s1}$[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	-	0.0056	-	0.0010	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02[B] 0.09[C]	0.02[D]	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	-	0.019	-	0.0030	<0.00080	<0.00080	<0.00080	<0.00080
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	n/v	2.2[D]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	n/v	1.1[D]	0.47	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics																			
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	6.2	8.0	4.3	9.2	2.8	4.7	4.2	3.1	-	4.6	-	4.9	6.3	3.3	4.1	5.6
Electrical Conductivity, Lab	µS/cm	n/v	1000[D]	**5900[D]**	**2600[D]**	**3300[D]**	**3900[D]**	**1100[D]**	**1700[D]**	**3000[D]**	**3100[D]**	**2600[D]**	**5400[D]**	**6900[D]**	**1100[D]**	**2500[D]**	**2200[D]**	**1100[D]**	**1100[D]**
pH	S.U.	6.5-8.5[B]	6.5-8.5[D]	7.95	8.16	7.53	7.57	7.90	7.88	7.65	7.99	7.97	7.57	7.81	8.01	7.56	8.04	7.94	8.11
Anions																			
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	520	450	330	380	370	510	380	410	410	630	520	420	420	180	600	470
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	630	550	410	470	450	630	470	500	510	770	640	510	520	220	730	580
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulfate	mg/L	≤500[B]	500[D]	**3500 CD[BD]**	**1100 CD[BD]**	**1800 CD[BD]**	**2200 CD[BD]**	140	490 CD	**1800 CD[BD]**	**1500 CD[BD]**	**900 CD[BD]**	**3100 CD[BD]**	**4800 CD[BD]**	100	**1100 CD[BD]**	**1100 CD[BD]**	70	150
Chloride	mg/L	≤250[B]	100[D]	6.0	12	4.3	14	60	1.6	7.1	1.7	**230 CD[D]**	7.9	8.7	72	1.9	4.9	3.5	8.2
Nutrients																			
Ammonia (as N)	mg/L	n/v	0.261-190$_{n1}$[D]	0.27	0.20	0.37	0.16	0.055	0.16	0.59	0.49	-	0.60	-	<0.050	0.070	0.68	0.14	0.12
Nitrite (as N)	mg/L	1[C]	0.06[D]	0.024	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	**0.17[D]**	0.031	<0.010	<0.010	<0.010	<0.010
Nitrate (as N)	mg/L	10[C]	3[D]	<0.050 MI	0.29	<0.010	<0.010	1.6	0.015	0.027	<0.010	0.34	0.031	1.1	1.2	0.42	0.012	<0.010	0.015
Orthophosphate(as P)	mg/L	n/v	n/v	0.0041	0.0099 OG	<0.0030	0.012 OG	<0.0030	0.0036	<0.0030	<0.0030	-	0.0045	-	<0.0030	<0.0030	0.0076 OG	<0.0030	0.0086
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	0.0094	0.0067	<0.0030	0.0065	0.0045	0.0059	0.0035	0.0033	-	0.011	-	0.0038	0.0037	<0.0030	<0.0030	0.016
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	5.1 DB	1.7 DB	6.5 DB	0.62	0.95	0.20	5.4 CD	3.7 DB	-	14 DB	-	1.3	0.70 DB	0.97	2.8 CD	0.54 DB

See notes on last page.

Table 3-4
Water Quality Analytical Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters
Springbank SR1 Well Survey

Sample Location				MW16-2-6	MW16-3-7	MW16-6-11	MW16-7-5	MW16-8-8	MW16-9-6	MW16-10-15	MW16-11-15	MW16-12-3	MW16-16-11	MW16-17-5	MW16-18-6	MW16-19-8	MW16-22-26	MW16-23-14	MW16-25-9
Sample Date				**30-Sep-16**	**28-Sep-16**	**27-Sep-16**	**27-Sep-16**	**4-Oct-16**	**30-Sep-16**	**4-Oct-16**	**30-Sep-16**	**6-Oct-16**	**3-Oct-16**	**6-Oct-16**	**4-Oct-16**	**27-Sep-16**	**28-Sep-16**	**29-Sep-16**	**30-Sep-16**
Aquifer				Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
Lithology	**Units**	**Health Canada**	**AEP**	Sandstone	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glacial Till	Glacial Till	Glacial Till	Glaciolacustrine Clay	Basal Silt and Sand	Basal Silt and Sand	Glacial Till	Glacial Till	Glacial Till
Metals, Dissolved																			
Aluminum	mg/L	0.1/0.2$_a$[B]	0.1/0.050$_{rt2}$[D]	0.016	0.0064	0.0041	0.0048	<0.0030	<0.0030	0.0042	<0.0030	0.0070	0.0056	0.0039	<0.0030	0.0039	0.0036	<0.0030	0.028
Antimony	mg/L	0.006[C]	0.006[D]	0.00073	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00079	<0.00060	<0.00060	<0.00060	0.00062	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.010[C]	0.005[D]	0.0044	0.00078	0.00050	0.0010	<0.00020	0.00093	0.0012	0.0012	0.00092	0.00085	0.00053	0.00022	0.00030	0.00073	**0.0056[D]**	0.00078
Barium	mg/L	1.0[C]	1[D]	0.018	0.035	0.021	0.032	0.039	0.039	0.022	0.016	0.12	0.026	0.041	0.075	0.013	0.034	0.12	0.053
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	5[C]	1.0[D]	0.11	0.10	0.13	0.12	0.043	0.14	0.12	0.10	0.051	0.20	0.12	0.088	0.092	0.098	0.13	0.099
Cadmium	mg/L	0.005[C]	0.011/0.040$_{rt2}$[D]	0.000092	0.000036	0.000058	0.00013	0.000040	0.000073	0.00010	0.000043	0.000036	0.00014 NF	0.00028	<0.000020	0.000057	<0.000020	0.000033	0.000065
Calcium	mg/L	n/v	n/v	390	170	310	250	120	220	320	290	270	440	410	86	230	170	130	140
Chromium	mg/L	0.05[C]	0.0049$_{s2}$[D]	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0043	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0060	0.0023	0.0041	0.0051	0.00057	0.0037	0.0043	0.0016	<0.00030	0.0037	0.00083	<0.00030	<0.00030	0.00087	0.0020	0.0020
Copper	mg/L	≤1.0[B]	0.007[D]	0.00084	0.00085	<0.00020	0.00097	0.00032	0.00064	<0.00020	0.00029	0.0018	**0.0097[D]**	0.0017	0.00067	0.00059	<0.00020	<0.00020	0.0011
Iron	mg/L	≤0.3[B]	0.3[D]	<0.060	0.17	0.11	<0.060	<0.060	0.13	<0.060	**0.37[BD]**	<0.060	<0.060	<0.060	<0.060	<0.060	0.11	**0.50[BD]**	0.16
Lead	mg/L	0.010[C]	0.068$_{rt2}$[D]	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.11	0.057	0.049	0.077	<0.020	0.030	0.055	0.050	0.030	0.15	0.15	0.026	0.029	0.064	0.032	0.034
Magnesium	mg/L	n/v	n/v	400	130	140	230	60	94	140	110	160	320	600 CD	63	99	54	53	59
Manganese	mg/L	≤0.05[B]	0.05[D]	**1.5[BD]**	**0.39[BD]**	**0.85[BD]**	**0.81[BD]**	**0.12[BD]**	**0.93[BD]**	**1.0[BD]**	**0.77[BD]**	0.025	**2.3[BD]**	**0.39[BD]**	**0.058[BD]**	**0.071[BD]**	**0.51[BD]**	**0.75[BD]**	**0.23[BD]**
Mercury	µg/L	1[C]	0.005[D]	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	0.0036	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0035
Molybdenum	mg/L	n/v	n/v	0.0071	0.0020	0.0014	0.0026	0.0011	0.00082	0.0034	0.0015	0.0021	0.0011	0.0015	0.0019	0.00060	0.0039	0.0053	0.0036
Nickel	mg/L	n/v	0.40/3.6$_{rt2}$[D]	0.016	0.0065	0.0064	0.011	0.0025	0.0071	0.013	0.0027	0.0041	0.0066	0.0054	0.00099	<0.00050	0.0018	0.0053	0.0067
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	9.4	6.1	8.5	5.9	5.8	5.6	11	6.0	6.4	15	11	2.4	5.9	7.1	6.5	6.6
Selenium	mg/L	0.05[C]	0.001[D]	**0.0013[D]**	0.00026	0.00044	0.00046	**0.011[D]**	<0.00020	0.00038	<0.00020	**0.0016[D]**	0.00038	**0.034[D]**	**0.0012[D]**	**0.056[CD]**	0.00023	<0.00020	**0.0014[D]**
Silicon	mg/L	n/v	n/v	5.9	5.1	5.0	5.6	4.2	5.5	4.5	4.8	6.1	6.3	5.2	4.1	3.6	4.8	6.5	7.0
Silver	mg/L	n/v	0.0001[D]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	≤200[B]	200[D]	**690 CD[BD]**	**320[BD]**	**330[BD]**	**400[BD]**	25	71	**330[BD]**	**320[BD]**	110	**600 CD[BD]**	**750 CD[BD]**	66	**260[BD]**	**310[BD]**	59	34
Strontium	mg/L	n/v	n/v	4.6	1.6	2.4	2.4	0.90	1.4	3.4	2.6	1.1	4.9	4.7	0.75	1.4	2.4	1.1	0.74
Sulfur	mg/L	n/v	n/v	1200 CD	370	580 CD	700 CD	45	180	650 CD	480	270	1000 CD	1500 CD	29	370	350	25	49
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.02[C]	0.01[D]	**0.040[CD]**	**0.014[D]**	0.0085	**0.020[D]**	**0.011[D]**	0.0086	**0.012[D]**	0.0071	0.010	**0.033[CD]**	**0.031[CD]**	**0.011[D]**	**0.013[D]**	0.0044	0.0052	**0.014[D]**
Vanadium	mg/L	n/v	n/v	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011
Zinc	mg/L	≤5.0[B]	0.03[D]	0.016	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0053	<0.0030	<0.0030	0.0062	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Metals, Total																			
Mercury	µg/L	1[C]	0.005[D]	***<6.0 DB***	***<6.0 DB***	***<20 DB***	***<2.0 DB***	***<20 DB***	***<0.020 DB***	***<20 DB***	***<6.0 DB***	**0.30 DB[D]**	***<6.0 DB***	***<0.20 DB***	***<6.0 DB***	***<2.0 DB***	***<6.0 DB***	***<20 DB***	***<2.0 DB***
Microbiological Parameters																			
Escherichia coli (E.Coli)	mpn/100mL	0[A]	n/v	***<100 DB***	***<10 DB***	***<100***	***<10***	***<100 DB***	***<1.0***	***<100 DB***	***<100 DB***	-	***<100 DB***	-	***<10 DB***	**63[A]**	***<10 DB***	***<10 DB***	***<10 DB***
Fecal Coliform	mpn/100mL	n/v	n/v	<100 DB	<10 DB	<100 DB	<10 DB	<100 DB	<1.0	100 DB	<100 DB	-	<100 DB	-	<10 DB	<10 DB	<10 DB	<10 DB	<10 DB
Heterotrophic Plate Count	cfu/mL	n/v	n/v	49000 DB	6000 >	56000 DB	920	34000 DB	1100	6000 DB>	23000 DB	-	50000 DB	-	4400 DB	6000 >	6000 >	20000 DB	7900 DB
Total Coliforms	mpn/100mL	0[A]	n/v	***<100 DB***	**450 DB[A]**	**9300[A]**	**1700[A]**	***<100 DB***	**390[A]**	**9100 DB[A]**	**100 DB[A]**	-	**200 DB[A]**	-	**140 DB[A]**	**280[A]**	**2000 DB[A]**	**2400 DB>[A]**	**2400 DB>[A]**

See notes on last page.

Table 3-4
Water Quality Analytical Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters
Springbank SR1 Well Survey

Sample Location				MW16-27-12	MW16-1-15	MW16-4-22	MW16-5-11	MW16-6-20	MW16-8-19	MW16-14-33	MW16-15-34	MW16-18-10	MW16-19-19	MW16-20-21	MW16-21-11	MW16-23-36	MW16-24-30	MW16-26-18
Sample Date				**28-Sep-16**	**3-Oct-16**	**4-Oct-16**	**4-Oct-16**	**27-Sep-16**	**4-Oct-16**	**27-Sep-16**	**26-Sep-16**	**4-Oct-16**	**27-Sep-16**	**27-Sep-16**	**29-Sep-16**	**29-Sep-16**	**28-Sep-16**	**28-Sep-16**
Aquifer				Surficial	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock
Lithology				Glacial Till	Sandstone	Sandstone	Sandstone	Claystone/ Siltstone	Sandstone	Siltstone/ Claystone	Siltstone	Claystone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Claystone
	Units	**Health Canada**	**AEP**															
Calculated Parameters																		
Anion Sum	meq/L	n/v	n/v	25	25	54	8.8	21	15	45	11	13	36	25	9.2	14	13	14
Cation Sum	meq/L	n/v	n/v	22	28	50	8.7	21	14	160	10	12	34	24	9.9	14	14	14
Hardness (as CaCO3)	mg/L	n/v	n/v	800	1000	1700	340	340	580	6700	52	160	600	740	440	180	160	140
Ion Balance	none	n/v	n/v	0.90	1.1	0.94	0.99	0.98	0.93	3.4	0.95	0.93	0.95	0.97	1.1	0.99	1.1	1.0
Nitrate	mg/L	45[C]	13[D]	<0.044	<0.044	<0.044	3.3	0.086	3.1	0.072	<0.044	0.51	<0.044	0.085	**21[D]**	<0.044	<0.044	<0.044
Nitrate + Nitrite (as N)	mg/L	n/v	100[D]	<0.020	<0.020	<0.020	0.76	<0.020	0.70	<0.020	<0.020	0.13	<0.020	<0.020	4.8	<0.020	<0.020	<0.020
Nitrite	mg/L	3[C]	0.06[D]	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	0.054	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	≤500[B]	500[D]	**1400[BD]**	**1600[BD]**	**3400[BD]**	440	**1400[BD]**	**750[BD]**	**4700[BD]**	**610[BD]**	**680[BD]**	**2200[BD]**	**1500[BD]**	480	**850[BD]**	**730[BD]**	**870[BD]**
BTEX and Petroleum Hydrocarbons																		
Benzene	mg/L	0.005[C]	0.005[D]	<0.00040	<0.00040	<0.00040	0.00055	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0010	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024[B] 0.06[C]	0.024[D]	<0.00040	<0.00040	<0.00040	0.0013	<0.00040	<0.00040	<0.00040	<0.00040	0.0013	<0.00040	0.00050	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016[B] 0.14[C]	0.0016[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00068	<0.00040	<0.00040	0.00059	<0.00040	<0.00040	<0.00040
Xylene, m & p-	mg/L	n/v	n/v	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.0029	<0.00080	<0.00080	0.00090	<0.00080	<0.00080	<0.00080
Xylene, o-	mg/L	n/v	$_{s1}$[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0012	<0.00040	<0.00040	0.0010	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02[B] 0.09[C]	0.02[D]	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.0041	<0.00080	<0.00080	0.0019	<0.00080	<0.00080	<0.00080
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	n/v	2.2[D]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	n/v	1.1[D]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics																		
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	1.8	2.6	5.1	2.8	4.1	1.3	3.9	1.7	2.6	3.9	3.8	4.8	2.9	1.2	2.1
Electrical Conductivity, Lab	µS/cm	n/v	1000[D]	**2000[D]**	**2100[D]**	**4000[D]**	780	**2000[D]**	**1300[D]**	**2000[D]**	1000	**1200[D]**	**3000[D]**	**2100[D]**	800	**1300[D]**	**1100[D]**	**1300[D]**
pH	S.U.	6.5-8.5[B]	6.5-8.5[D]	7.77	7.88	7.52	7.96	7.99	7.74	7.80	8.31	8.10	7.54	7.59	7.96	8.22	8.19	8.29
Anions																		
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	81	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	530	300	460	380	260	460	1500	350	410	520	450	390	290	460	260
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	650	360	570	470	320	560	1600	430	500	640	540	470	350	560	310
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	97	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulfate	mg/L	≤500$_j$[B]	500[D]	**690 CD[BD]**	**910 CD[BD]**	**2100 CD[BD]**	43	**770 CD[BD]**	110	**730 CD[BD]**	170	110	**1200 CD[BD]**	**760 CD[BD]**	50	380 CD	160	400 CD
Chloride	mg/L	≤250[B]	100[D]	2.1	3.8	3.0	4.8	4.0	**110[D]**	25	3.4	78	1.7	3.3	4.6	3.2	<1.0	2.0
Nutrients																		
Ammonia (as N)	mg/L	n/v	0.261-190$_{nl}$[D]	0.38	<0.050	0.96	0.062	0.49	<0.050	1.5	0.99 A*	<0.050	1.1	0.57	<0.050	0.83	0.86	0.64
Nitrite (as N)	mg/L	1[C]	0.06[D]	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (as N)	mg/L	10[C]	3[D]	<0.010	<0.010	<0.010	0.76	0.020	0.70	0.016	<0.010	0.12	<0.010	0.019	**4.8[D]**	<0.010	<0.010	<0.010
Orthophosphate(as P)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0039	0.0038	<0.0030	<0.0030	<0.0030	0.0041 OG	0.0040 OG	<0.0030	<0.0030
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030 XN	0.0034	<0.0030	<0.0030	0.0073	0.0057	<0.0030	<0.0030	<0.0030	0.013	0.013	<0.0030	0.0062
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.1	1.5 DB	1.1	7.5 DB	1.3	1.3	38 CD	0.90 A*	18 CD	1.5 DB	11 DB	3.3 DB	1.3	0.88	4.5 DB

See notes on last page.

Table 3-4
Water Quality Analytical Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters
Springbank SR1 Well Survey

Sample Location				MW16-27-12	MW16-1-15	MW16-4-22	MW16-5-11	MW16-6-20	MW16-8-19	MW16-14-33	MW16-15-34	MW16-18-10	MW16-19-19	MW16-20-21	MW16-21-11	MW16-23-36	MW16-24-30	MW16-26-18
Sample Date				**28-Sep-16**	**3-Oct-16**	**4-Oct-16**	**4-Oct-16**	**27-Sep-16**	**4-Oct-16**	**27-Sep-16**	**26-Sep-16**	**4-Oct-16**	**27-Sep-16**	**27-Sep-16**	**29-Sep-16**	**29-Sep-16**	**28-Sep-16**	**28-Sep-16**
Aquifer				Surficial	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock
Lithology				Glacial Till	Sandstone	Sandstone	Sandstone	Claystone/ Siltstone	Sandstone	Siltstone/ Claystone	Siltstone	Claystone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Claystone
	Units	**Health Canada**	**AEP**															
Metals, Dissolved																		
Aluminum	mg/L	0.1/0.2$_a$[B]	0.1/0.050$_{rt2}$[D]	<0.0030	<0.0030	<0.0030	0.011	0.0067	<0.0030	0.016 NF XN	0.0040	<0.0030	0.0033	0.0040	0.0033	0.0074	<0.0030	0.0037
Antimony	mg/L	0.006[C]	0.006[D]	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.0021	0.0013	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.010[C]	0.005[D]	0.00036	<0.00020	0.0017	0.0010	0.00043	<0.00020	0.0017	0.0010	0.00039	0.00033	0.00043	0.00045	0.00035	0.0023	<0.00020
Barium	mg/L	1.0[C]	1[D]	<0.010	0.018	<0.010	0.068	0.031	0.054	**3.8**[CD]	0.013	0.030	<0.010	0.018	0.087	0.030	0.019	<0.010
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	5[C]	1.0[D]	0.13	0.078	0.11	0.036	0.093	0.043	***<2.0***	0.040	0.14	0.13	0.076	0.061	0.086	0.089	0.13
Cadmium	mg/L	0.005[C]	0.011/0.040$_{rt2}$[D]	0.000026	<0.000020	<0.000020	<0.000020	<0.000020	0.000029	0.000024	<0.000020	<0.000020	<0.000020	<0.000020	0.000073	<0.000020	<0.000020	<0.000020
Calcium	mg/L	n/v	n/v	200	230	380	76	76	130	2300	14	38	140	160	86	50	38	40
Chromium	mg/L	0.05[C]	0.0049$_{s2}$[D]	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0014	0.0012	0.00034	0.0010	0.00056	<0.00030	0.00065	<0.00030	0.00034	<0.00030	0.00085	0.00062	<0.00030	<0.00030	<0.00030
Copper	mg/L	≤1.0[B]	0.007[D]	<0.00020	<0.00020	<0.00020	<0.00020	0.00056	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0013	<0.00020	<0.00020	0.00021
Iron	mg/L	≤0.3[B]	0.3[D]	**0.42**[BD]	<0.060	**2.2**[BD]	0.061	<0.060	<0.060	**68**[BD]	<0.060	<0.060	**2.6**[BD]	**0.69**[BD]	0.078	<0.060	0.14	0.15
Lead	mg/L	0.010[C]	0.068$_{rt2}$[D]	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.041	0.022	0.070	<0.020	0.044	<0.020	<2.0	0.074	0.031	0.056	0.053	0.028	0.066	0.054	0.035
Magnesium	mg/L	n/v	n/v	75	110	180	38	36	60	190	4.2	16	62	82	54	14	16	11
Manganese	mg/L	≤0.05[B]	0.05[D]	**0.41**[BD]	**0.88**[BD]	**0.60**[BD]	**0.15**[BD]	**0.16**[BD]	0.0062	**14**[BD]	0.028	**0.20**[BD]	**0.37**[BD]	**0.34**[BD]	**0.17**[BD]	**0.083**[BD]	**0.067**[BD]	**0.083**[BD]
Mercury	µg/L	1[C]	0.005[D]	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Molybdenum	mg/L	n/v	n/v	0.00058	0.0028	0.0016	0.012	0.0060	0.00085	0.028	0.018	0.0037	0.0012	0.0052	0.0010	0.0023	0.0014	0.0048
Nickel	mg/L	n/v	0.40/3.6$_{rt2}$[D]	0.00062	0.0010	<0.00050	0.0020	<0.00050	<0.00050	0.0036	<0.00050	<0.00050	<0.00050	<0.00050	0.0016	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	49	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	4.9	4.8	8.2	3.7	4.9	5.7	53	2.4	1.3	5.9	8.9	7.6	4.2	4.0	2.8
Selenium	mg/L	0.05[C]	0.001[D]	<0.00020	<0.00020	<0.00020	**0.0031**[D]	<0.00020	**0.0080**[D]	**0.0011**[D]	0.00065	0.00066	<0.00020	0.00090	**0.0019**[D]	<0.00020	<0.00020	<0.00020
Silicon	mg/L	n/v	n/v	5.7	4.7	4.3	4.2	3.4	3.7	25	2.6	3.4	3.4	4.0	4.7	3.8	3.6	4.5
Silver	mg/L	n/v	0.0001[D]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	≤200[B]	200[D]	140	160	**370**[BD]	39	**320**[BD]	47	**410**[BD]	**210**[BD]	**200**[B]	**490**[BD]	**210**[BD]	21	**230**[BD]	**240**[BD]	**250**[BD]
Strontium	mg/L	n/v	n/v	1.6	1.6	6.0 CD	0.82	0.78	1.3	9.7	0.25	0.27	2.1	2.0	1.1	0.77	0.66	0.61
Sulfur	mg/L	n/v	n/v	180	340	730 CD	13	250	29	220	51	33	370	240	19	120	51	130
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.02[C]	0.01[D]	0.0049	0.0054	0.0023	0.0053	0.0021	0.0053	**0.012**[D]	0.00024	0.0064	0.00092	0.0032	0.0067	0.00010	0.00022	0.00013
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	≤5.0[B]	0.03[D]	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Metals, Total																		
Mercury	µg/L	1[C]	0.005[D]	***<20 DB***	***<2.0 DB***	***<2.0 DB***	***<20 DB***	***<0.20 DB***	***<0.10 DB***	***<20 DB***	***<0.10 DB***	***<6.0 DB***	***<0.20 DB***	***<6.0 DB***	***<20 DB***	***<0.20 DB***	<0.0020	***<6.0 DB***
Microbiological Parameters																		
Escherichia coli (E.Coli)	mpn/100mL	0[A]	n/v	***<10 DB***	***<10 DB***	***<2.0 DB***	***<100 DB***	***<1.0***	***<1.0***	***<20***	***<1.0***	***<100 DB***	***<10***	***<100***	***<10 DB***	**11**[A]	***<1.0***	***<10 DB***
Fecal Coliform	mpn/100mL	n/v	n/v	<10 DB	<10 DB	<2.0 DB	<100 DB	<1.0	<1.0	<20 DB	<1.0	<100 DB	<10 DB	<100 DB	<10 DB	5.1	<1.0	<10 DB
Heterotrophic Plate Count	cfu/mL	n/v	n/v	980	4900 DB	550 DB	44000 DB	6000 >	620	6000 >	39	17000 DB	1700	17000 DB	3200 DB	400	48	6000 >
Total Coliforms	mpn/100mL	0[A]	n/v	**850 DB**[A]	**230 DB**[A]	***<2.0 DB***	***<100 DB***	**2400 >**[A]	**27**[A]	**2300**[A]	***<1.0***	**310 DB**[A]	**10**[A]	**750**[A]	**20 DB**[A]	**520**[A]	**2.0**[A]	**580 DB**[A]

See notes on last page.

Table 3-4
Water Quality Analytical Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters
Springbank SR1 Well Survey

Notes:

Health Canada	Health Canada (2014). Guidelines for Canadian Drinking Water Quality - Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
A	Guidelines for Canadian Drinking Water Quality - Microbial Parameters
B	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives/ Operational Guidelines
C	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentration
AEP	Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division 197 pp.
D	Table 2. Alberta Tier 1 Groundwater Remediation Guidelines - Agricultural - Fine
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
a	This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants; it does not apply to naturally occuring aluminum found in groundwater.
	The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
j	High levels (above 500 mg/L) can cause physiological effects such as diarrhoea or dehyrdration.
n1	See Environmental Quality Guidelines for Alberta Surface Waters (ESRD, 2014) for further guidance on aquatic life pathway. (Equation, varies with pH and temperature)
n2	Tier 1 guideline = lowest of aquatic life guideline and all other guidelines (See Appendix B of Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Polic
	See Environmental Quality Guidelines for Alberta Surface Waters (ESRD, 2014) for further guidance on aquatic life pathway. Aluminum, Cadmium and Nickel both have short and long term values which are re
s1	Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
s2	There is no applicable total Chromium guideline, therefore the value from Chromium (trivalent) is applied.
>	Greater than.
A*	Ammonia greater than TKN. Results are within acceptable limits of precision.
CD	Detection limits raised due to dilution to bring analyte within the calibrated range.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
MI	Detection limit was raised due to matrix interferences.
NF	Duplicate exceeds acceptance criteria due to sample non homogeneity.
OG	Orthophopshate greater than phosphate. Results within acceptable limits of precision.
XN	Matrix Spike exceeds acceptance limits, due to matrix interference. Reanalysis yields similar results.

Table 3-5 Summary of Laboratry Analytical Results from the Domestic Well Testing Program

Calculated Parameters	Units	Minimum	Maximum	Average	Standard Deviation
Hardness (as CaCO3)	mg/L	56	780	348	213
Nitrate	mg/L	<0.044	11	NC	NC
Nitrate + Nitrite (as N)	mg/L	<0.020	2.5	NC	NC
Nitrite	mg/L	<0.033	0.089	NC	NC
Total Dissolved Solids	mg/L	260	2800	761	680
Electrical Conductivity, Lab	µS/cm	470	3800	1253	911
pH	S.U.	7.56	8.13	7.88	0.21
Anions					
Alkalinity (P as CaCO3)	mg/L	<0.50	<0.50	NC	NC
Alkalinity, Total (as CaCO3)	mg/L	150	1100	431	250
Alkalinity, Bicarbonate (as CaCO3)	mg/L	180	1300	523	295
Alkalinity, Carbonate (as CaCO3)	mg/L	<0.50	<0.50	NC	NC
Alkalinity, Hydroxide (as CaCO3)	mg/L	<0.50	<0.50	NC	NC
Sulfate	mg/L	36	1200	176	324
Chloride	mg/L	1.6	350	59	106
Fluoride	mg/L	0.1	0.62	0.24	0.15
Nutrients					
Nitrite (as N)	mg/L	<0.010	0.027	NC	NC
Nitrate (as N)	mg/L	<0.010	2.5	NC	NC
Metals, dissolved					
Aluminum	mg/L	<0.0030	0.012	NC	NC
Antimony	mg/L	<0.00060	0	NC	NC
Arsenic	mg/L	<0.00020	0.00085	NC	NC
Barium	mg/L	<0.05	0.082	NC	NC
Beryllium	mg/L	<0.0010	0	NC	NC
Boron	mg/L	<0.020	0.14	NC	NC
Cadmium	mg/L	<0.000020	0.000077	NC	NC
Calcium	mg/L	14	180	79	45
Chromium	mg/L	<0.0010	0	NC	NC
Cobalt	mg/L	<0.00030	0.00046	NC	NC
Copper	mg/L	<0.00020	0.013	NC	NC
Iron	mg/L	<0.060	0.4	NC	NC
Lead	mg/L	<0.00020	0.00099	NC	NC
Lithium	mg/L	<0.020	0.14	NC	NC
Magnesium	mg/L	4.8	82	37	26
Manganese	mg/L	<0.0040	0.18	NC	NC
Mercury	mg/L	<0.00000200	0.0000025	NC	NC
Molybdenum	mg/L	0.00045	0.013	0.0024	0
Nickel	mg/L	<0.00050	0.0024	NC	NC
Phosphorus	mg/L	<0.10	0	NC	NC
Potassium	mg/L	<0.6	7.1	NC	NC
Selenium	mg/L	<0.0005	0.0059	NC	NC
Silicon	mg/L	1.6	4.3	2.7	1
Silver	mg/L	<0.00010	<0.00010	NC	NC
Sodium	mg/L	4.3	750	142	206
Strontium	mg/L	0.27	2.1	0.97	0.70
Sulfur	mg/L	10	270	47	72
Thallium	mg/L	<0.00020	<0.00020	NC	NC
Tin	mg/L	<0.0010	<0.0010	NC	NC
Titanium	mg/L	<0.0010	0.007	NC	NC
Uranium	mg/L	0.00032	0.0061	NC	NC
Vanadium	mg/L	<0.0010	0.0011	NC	NC
Zinc	mg/L	<0.0030	4	NC	NC
Bacteriological					
Escherichia coli (E.Coli)	mpn/100mL	<1.0	<1.0	NC	NC
Total Coliforms	mpn/100mL	<1.0	2400	NC	NC

3.4.1 Groundwater Chemistry of the Unconsolidated Deposits

A total of 17 groundwater samples were collected from wells completed in the unconsolidated deposits in the LAA. The TDS concentrations in the unconsolidated deposits ranged from 640 mg/L to 6,900 mg/L, with an average concentration of 2,381 mg/L. These TDS concentrations exceeded both guidelines and are considered slightly to moderately saline. At three locations (MW16-2-6, MW16-16-11, MW16-17-5), the TDS concentrations exceeded the definition of "fresh water" (TDS less than 4,000 mg/L) under the Alberta's Water (Ministerial) Regulation.

Figure 3-25 indicates that there is no dominant cation characteristic of the unconsolidated deposits; samples are near the center of the lower left portion of the plot. Sodium concentrations are relatively high with 10 of 17 samples exceeding the 200 mg/L guidelines. Sulphate is the dominant anion in 12 samples with bicarbonate dominating the remaining five. The average sulphate concentration was 1,444 mg/L with the majority of samples exceeding both guidelines (500 mg/L). Chloride concentrations were low in the majority of samples ranging from 1.6 mg/L to 17 mg/L, with the exception of MW16-12-3 (230 mg/L) and MW16-17-5 (72 mg/L).

Nutrient concentrations—ammonia, nitrate, nitrite, phosphate and total Kjeldahl nitrogen—were analyzed because they are contaminants of potential concern in agricultural settings. Nutrient concentrations were low in all samples except for MW16-17-5, which had nitrite-nitrogen above the Alberta Tier 1 Guideline. The nitrite concentration was 0.17 mg/L-N compared to a guideline value of 0.06 mg/L-N.

Dissolved metals concentrations were generally within the range of expected concentrations for monitoring wells completed in glacial deposits in southern Alberta. Iron concentrations exceeded the 0.3 mg/L guideline at three locations with a maximum concentration 0.5 mg/L. Manganese concentrations exceeded the guidelines (0.05 mg/L) in all samples except MW16-11-15 (with values ranging from 0.025 to 2.3 mg/L). Selenium concentrations exceeded the 0.001 mg/L Alberta Tier 1 Guideline in seven samples and exceeded the 0.05 mg/L GCDWQ in one sample from MW16-19-8. Uranium concentrations exceeded the 0.01 mg/L guidelines in 10 of 17 samples with values ranging from 0.0044 to 0.04 mg/L. Single exceedances of arsenic at MW16-23-14 and copper at MW16-16-11 were also noted with concentrations marginally exceeding guidelines.

Dissolved mercury was below the 0.002 µg/L laboratory detection limit in 14 of 17 samples. Concentrations in the remaining three samples were marginally above the detection limit with values ranging from 0.002 to 0.0036 µg/L. Total mercury was also analysed in all samples; however, given the amount of sediment entrained in many of the samples as a result of the fine-grained aquifer material, the laboratory detection limits had to be raised for many samples. Detection limits ranged from 0.02 µg/L to 20 µg/L.

Hydrocarbon concentrations were below their respective guideline concentrations at all monitoring wells except for MW16-16-11. Benzene and ethylbenzene marginally exceeded guidelines with concentrations of 0.0055 and 0.0034 mg/L, respectively. The source of the hydrocarbon impacts is not known. Dissolved organic carbon concentrations ranged from 1.8 mg/L to 9.2 mg/L.

Bacteriological parameters including Escherichia coli (E. Coli), fecal coliform, total coliforms and heterotrophic plate counts (HPC) were enumerated for all samples. As with the mercury analyses described above, sediment in the samples also affected the detection limits for the bacteriological parameters. While the detection limits were not low enough to determine if the water is safe for human consumption in the majority of samples, it does provide general information on the bacteriological levels and potential for preexisting impacts in the shallow groundwater.

HPC's were included in the analytical suite to provide information on the level of bacteriological activity across the LAA. HPC concentrations varied significantly from 920 cfu/100 mL at MW16-7-5 to 56,000 cfu/100 mL at MW16-6-11. No spatial or depth correlation was evident in the HPC data. E.coli concentrations were below the detection limits in all samples except MW16-19-8, which had an E.coli concentration of 63 mpn/100 mL, compared to the GCDWQ of 0 mpn/100 mL. Total coliform bacteria ranged from less than 100 mpn/100 mL to 9,300 mpn/100 mL. Fecal coliform bacteria were below the detection limit in all samples except MW16-10-5, which had a concentration of 100 mpn/100 mL.

3.4.2 Groundwater Chemistry of the Upper Bedrock Aquifers

A total of 14 groundwater samples were collected from Project-related monitoring wells completed in bedrock within the LAA. Samples collected from domestic water wells were also available from the domestic well testing program completed in April 2016.

The TDS concentrations in the bedrock deposits ranged from 440 mg/L to 4,700 mg/L, with an average concentration of 1,444 mg/L. The bedrock TDS concentrations are significantly lower than in the surficial deposits but still exceed both guidelines in 12 of the 14 samples and are considered slightly saline. The TDS exceeded the 4,000 mg/L Water (Ministerial) Regulation criteria for fresh water at MW16-14-33. TDS concentrations were lower in the 12 domestic wells sampled, with an average concentration of 761 mg/L.

Figure 3-25 indicates that sodium is the dominant cation in 8 of the 14 bedrock samples with the remaining samples plotting near the center of the lower left portion of the plot having no dominant cation. Sodium concentrations exceed the 200 mg/L guideline in 12 of the 15 samples, with an average concentration of 222 mg/L. Bicarbonate is the dominant anion in 7 of the 14 samples, with sulphate dominating the remaining. The average sulphate concentration was 564 mg/L, which is lower than in the surficial deposits. Chloride concentrations were low in the

majority of samples, ranging from less than 1 mg/L to 78 mg/L, except for MW16-8-9, which had a concentration of 110 mg/L. Similar chloride concentrations were noted in the domestic water wells, with an average concentration of 59 mg/L.

Nutrient concentrations were low in all bedrock groundwater samples with the exception of one nitrate-nitrogen Alberta Tier 1 Guideline exceedance at MW16-21-5. The nitrite concentration at this monitoring well was 4.8 mg/L-N compared to a guideline value of 3 mg/L-N. Nitrate and nitrite concentrations were low and below guidelines in all domestic wells sampled.

Dissolved metals concentrations in the bedrock aquifers were relatively consistent across the LAA and similar to the surficial deposits with the exception of MW16-14-33, which had elevated barium (3.8 mg/L), iron (68 mg/L) and manganese (14 mg/L) concentrations. Iron concentrations exceeded the 0.3 mg/L guideline at three other locations, with a maximum concentration 2.6 mg/L. Manganese concentrations exceeded the guidelines (0.05 mg/L) in 12 of 14 samples. Selenium concentrations exceeded the 0.001 mg/L Alberta Tier 1 Guideline in four samples. Manganese and selenium exceedances were also noted in a number of domestic water wells sampled. Uranium concentrations were lower than in the surficial deposits with only one exceedance of the 0.01 mg/L guidelines at MW16-14-33, with a concentration of 0.012 mg/L.

Dissolved mercury was below the 0.002 µg/L laboratory detection limit in 13 of 14 samples. Concentrations in the remaining monitoring well (MW16-1-15) was marginally above the detection limit, with a value of 0.0029 µg/L. Total mercury concentrations were below the detection limits (0.1 µg/L to 20 µg/L) in all samples. Samples from the domestic wells also had mercury concentrations that were below the laboratory detection limits in 11 of 12 samples and marginally above the detection limit with a concentration of 0.0000025 mg/L in the remaining sample.

No hydrocarbon concentration exceedances were noted in any of the bedrock groundwater samples. Dissolved organic carbon concentrations ranged from 1.2 mg/L to 5.1 mg/L.

HPC concentrations were generally lower than in the surficial deposits, as expected, and ranged from 39 cfu/100 mL at MW16-15-34 to 44,000 cfu/100 mL at MW16-5-11. Lower HPC concentrations were generally found in deeper bedrock wells. E.coli concentrations were below the detection limits in all samples except MW16-23-36, which had an E.coli concentration of 11 mpn/100 mL, compared to the GCDWQ of 0 mpn/100 mL. Total coliform bacteria ranged from less than 1 mpn/100 mL to 2,400 mpn/100 mL. Fecal coliform bacteria were below the detection limit in all samples except MW16-23-36, which had a concentration of 5.1 mpn/100 mL. Total coliform bacteria in the domestic wells were low, and they ranged from from less than 1 mpn/100 mL to 24 mpn/100 mL in all samples, except one which had a concentration of 2,400 mpn/100 mL. E. Coli concentrations were below the detection limit in all domestic well samples.

3.5 GROUNDWATER QA/QC RESULTS

Two duplicate samples were collected as part of the QA/QC program to evaluate the precision or reproducibility of the analytical data between samples. A summary of the QA/QC data and analysis is included along with the laboratory reports in Attachment C.

The RPD between the sample and duplicate results was calculated for each sample or, when the parameter result was within five times the detection limit, the AD between the sample and duplicate was calculated. An RPD of 40% or less, or an AD of less than two times the detection limit, is considered acceptable for duplicate groundwater samples (CCME 2016).

A comparison of the duplicate sample results indicated that 99.3% (139 of 140 results) of the duplicate sample results meet the criteria referenced above. The one parameter result that did not meet the criteria was the heterotrophic plate count for the duplicate sample from MW16-24-30. Overall the reproducibility of the data is good and the analytical results are considered valid.

Laboratory QA/QC procedures and analysis are included with the analytical results in Attachment D. The quality assurance reports include analysis of matrix spikes, QC standards, blanks and calibration checks.

4.0 REFERENCES

Alberta Geology Survey (1980) Sheet 150: Surficial Geology of Alberta Foothills and Rocky Mountains

AMEC Environment and Infrastructure (AMEC) 2014. Preliminary Geotechnical Investigation Report – Off-Stream Dam Project – Springbank Alberta. Prepared for Alberta Transportation, May 2014.

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

Canadian Council of Ministers of the Environment (CCME) 2016. *Guidance Manual for the Environmental site Characterization in Support of Environmental and Human Health Risk Assessment*.

Fenton, M.M., Waters, E.J., Pawley, S.M., Atkinson, N., Utting, D.J. and Mckay, K. (2013): Surficial geology of Alberta; Alberta Energy Regulator, AER/AGS Map 601, scale 1:1 000 000

Glass, D. J. [editor]. 1990. Lexicon of Canadian Stratigraphy, Volume 4: Western Canada, including British Columbia, Alberta, Saskatchewan and southern Manitoba. Canadian Society of Petroleum Geologists, Calgary.

Grasby, S.E Chen, Z, Hamblin, A.P, Wozniak, P.R.J and Sweet, A.R (2008) Regional Characterization of the Paskapoo bedrock aquifer system, southern Alberta. Canadian Journal of Earth Sciences, Vol 45. pp1501-1516

Hamblin, A. P. 2010. Scollard/Willow Creek/Coalspur Formations: Summary of Literature and Concepts. Geological Survey of Canada, Open File 6555.

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50.

Hyder, Z., J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994. Slug tests in partially penetrating wells, Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

Hydrogeological Consultants Ltd. (HCL) 2002. M.D. of Rocky View No. 44 Part of the South Saskatchewan River Basin Tp 021 to 029, R25 to 29, W4M & Tp 023 to 029, R01 to 06, W5M Regional Groundwater Assessment. March 2002.

Jerzykiewicz, T. (1997) Stratigraphic Framework of the Uppermost Cretaceous to Paleocene Strata of the Alberta Basin. Bulletin 510. Geological Survey of Canada

MacCormack, K.E.., Atkinson, N and Lyster, S (2015) Map 602: Bedrock Topography of Alberta, Canada. Scale 1,000,000

Pana, D.I. and Elgr, R., comp. (2013). Geology of the Alberta Rocky Mountains and Foothills; Energy Resources Conservation Board, ERCB/AGS Map 560, scale 1:500,000.

Prior, G.J., Hathway, B., Glombick, P.M., Pană, D.I., Banks, C.J., Hay, D.C., Schneider, C.L., Grobe, M., Elgr, R. and Weiss, J.A. (2013): Bedrock geology of Alberta; Alberta Energy Regulator, AER/AGS Map 600, scale 1:1 000 00

Shetsen, I (1987) Sheet 207: Quaternary Geology of Southern Alberta. Scale: 1500,000

Toop, D.C. and N.N. de la Cruz, 2002. Hydrogeology of the Canmore Corridor and Northwestern Kananaskis Country, Alberta; Alberta Environment, Hydrogeology Section, Edmonton, Alberta; Report to Western Economic Partnership Agreement, Western Economic Diversification Canada.

Waterline Resources Inc. (Waterline). 2011. Groundwater Evaluation and Monitoring Plan Elbow River Watershed Sub-regions Twps 018 to 024, Rges 29W4 to 09W5 Alberta. Prepared for Alberta Environment. Calgary, Alberta.

Attachment A BOREHOLE LOGS AND RESPONSE TEST ANALYSIS

Monitoring Well: MW16-1-15 (GW1)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	19-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-33327.478
Contractor:	All Service Drilling Inc.	**Northing:**	5659967.274

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		SAND AND GRAVEL Fine to coarse grained	0.00
			SILT Medium brown, with clay, moist, high plastic	0.30
5			CLAY Medium brown, trace silt, moist, high plastic, few intermittent <150 mm thick silt lenses	1.52
10	2			
	4			
15			SILTY CLAY (TILL) Medium brown, with very fine to medium grained sand, some gravel, moist	4.88
20	6			
25	8			
			CLAY (TILL) Dark brown to dark grey, with gravel, some silt, low plastic	8.53
30	10			
35			SILTSTONE Grey to greenish grey, few fractures	10.06
40	12			
			SANDSTONE Medium grey, fine grained, moderate fracturing, minor oxidation and clay mineralization along fractures - @ 13.11 m: sand becomes interbedded with alternating grey and brown fine grained layers	12.19
45	14			
50				
	16			
55			End of Borehole	16.76

INSTALLATION DETAILS	Description
Diagram	0.805 m Stick-up
	Sand 0 to 1.83 m BGS
	Groundwater 3.70 m BGS May 19, 2016
	254 mm diameter borehole from 0 to 10.06 m
	Bentonite
	Solid pipe 51 mm diameter Schedule 40 PVC
	102 mm diameter borehole from 10.06 to 16.76 m
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 12.19 - 15.24 m BGS
Sand Pack Interval: 11.58 - 16.76 m BGS
Well Seal Interval: 1.83 - 11.58 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-1-15

Stantec

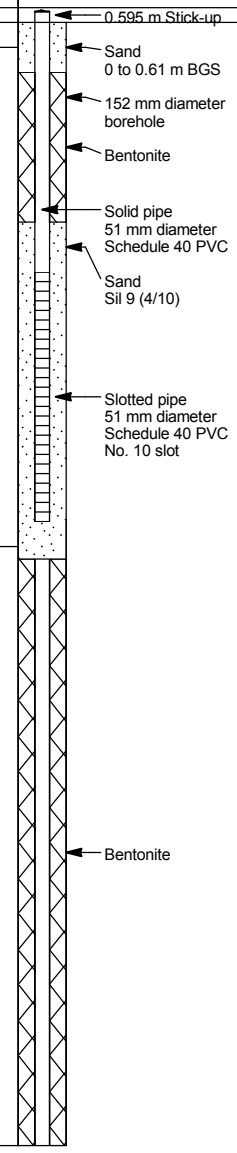
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-2-6 (GW2)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31947.274
Contractor:	All Service Drilling Inc.	**Northing:**	5659623.886

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			SOIL Black to dark brown, moist	0.00
			CLAY Brown to beige, some silt, moist, high plastic	0.30
5	2		- @ 2.13 m: becomes mottled beige and grey, silt content increases to 15-30%	
10	4		- @ 3.66 m: trace gravel and coal present	
20	6			
			SILT (TILL) Light brown, some fine grained sand stringers, with gravel and clay, moist, low plastic	6.40
25	8			
30	10			
35			- @ 10.67 m: grades to gravelly silt	
40	12			
45	14		End of Borehole	13.72



Screen Interval: 3.05 - 6.10 m BGS
Sand Pack Interval: 2.44 - 6.55 m BGS
Well Seal Interval: 6.55 - 13.72 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-2-6

Stantec

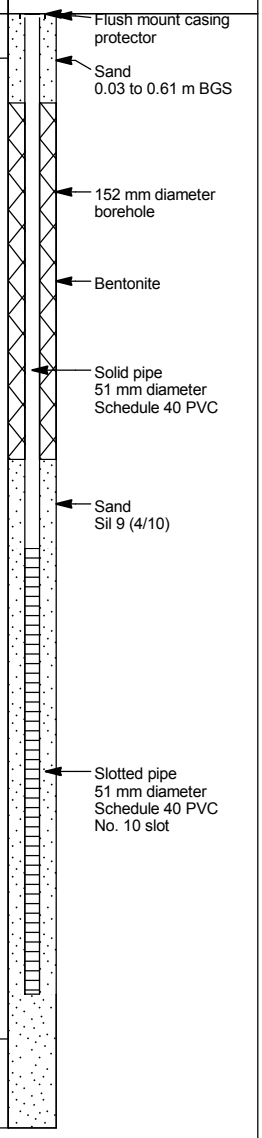
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-3-7 (GW3)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31904.435
Contractor:	All Service Drilling Inc.	**Northing:**	5659073.461

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			SAND AND GRAVEL (FILL)	0.00
			CLAY AND SILT Medium brown, moist, medium plastic	0.30
5	2		- @ 1.83 m: silt content decreases to 30-40%, high plastic	
10	4			
15			- from 5.18 to 6.10 m: layer of silt with clay, wet	
20	6			
			SILTY CLAY (TILL) Medium brown, some very fine grained sand, with gravel, dry to moist, low to medium plastic	7.01
25	8		End of Borehole	7.62



Screen Interval: 3.66 - 6.71 m BGS
Sand Pack Interval: 3.05 - 7.62 m BGS
Well Seal Interval: 0.61 - 3.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-3-7

Stantec

Drawn By/Checked By: M. Kuhl / D. King

STANTEC BOREHOLE AND WELL V2 110773396_NEW.GPJ STANTEC - DATA TEMPLATE.GDT 17/1/16 MKUHL

Monitoring Well: MW16-4-22 (GW4)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	20-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32259.324
Contractor:	All Service Drilling Inc.	**Northing:**	5658717.399

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		TOPSOIL	0.00
			CLAY Light to medium brown, with silt, moist, high plastic	0.30
5	2			
10	4			
15				
20	6			
			SILTY CLAY (TILL) Medium brown, some very fine to fine sand, with gravel, moist, high plastic	6.71
25	8		- @ 8.23 m: trace coal present	
30	10		- @ 9.45 m: sand component increases to 15-30% very fine to fine sand	
35			SILT AND CLAY (TILL) With very fine to fine sand, with gravel, dry to slighly moist, friable	10.97

Diagram / Description:

- 0.662 m Stick-up
- Sand 0 to 1.22 m BGS
- Bentonite
- Groundwater 2.38 m BGS May 20, 2016
- Cuttings and sand 1.83 to 4.88 m BGS
- 254 mm diameter borehole from 0 to 12.80 m
- Solid pipe 51 mm diameter Schedule 40 PVC
- Bentonite

Screen Interval: 18.59 - 21.64 m BGS
Sand Pack Interval: 18.29 - 21.95 m BGS
Well Seal Interval: 21.95 - 22.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-4-22

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-4-22 (GW4)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	20-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32259.324
Contractor:	All Service Drilling Inc.	**Northing:**	5658717.399

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			SILT AND CLAY (TILL) With very fine to fine sand, with gravel, dry to slighly moist, friable	
40	12			
			SANDSTONE Medium grey, very fine to fine grained, few fractures, some oxidation on fracture surfaces, no structure, massive	12.80
45	14			
			- @ 14.94 m: sandstone becomes slightly banded with alternating light grey and dark grey layers, no oxidation present	
50				
	16			
55				
			- @ 17.98 m: medium grained layers interbedded with finer grained layers become present	
60	18			
			- @ 20.12 m: sand begins to coarsen to medium grained sandstone, some clay along fractures	
65	20			
70				
			SILTSTONE Dark grey, highly fractured and altered - @ 21.95 m: clay mineralization along fractures	21.64
	22		SANDSTONE Medium grey, very fine grained	22.25
			CLAYSTONE Dark grey to black, few fractures	22.56
75			End of Borehole	22.86

INSTALLATION DETAILS	Description
Diagram	102 mm diameter borehole from 12.80 to 22.86 m
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
	Bentonite

Screen Interval: 18.59 - 21.64 m BGS
Sand Pack Interval: 18.29 - 21.95 m BGS
Well Seal Interval: 21.95 - 22.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-4-22

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-5-11 (GW5)

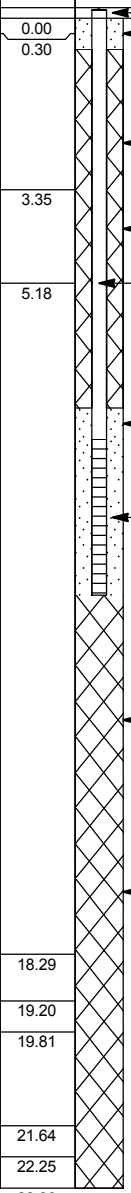
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	09-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31863.152
Contractor:	All Service Drilling Inc.	**Northing:**	5658164.716

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
			SILTY CLAY (TILL) Medium brown, some very fine grained sand, with gravel, moist, low plastic	0.30
5	2			
10	4		CLAY Mottled brown and grey, some gravel, some silt, moist, high plastic	3.35
15				
20	6		SANDSTONE brown, very fine to fine grained, few fractures with minor oxidation, massive - @ 5.49 : oxidized clay infill in 50 mm fracture	5.18
25	8		- @ 7.01 m: becomes silty, finer grained, with dark and light brown cross-bedding - @ 8.23 m: 50 mm coal seam, sandstone becomes massive again, few irregular coal stringers	
30			- @ 8.84 m: coarsens to a fine grained sandstone, very few fractures, weakly bedded	
35	10			
40	12			
45	14			
50			- @ 15.24 m: exhibits black and brown fine planar laminated beds, becomes very fine grained	
55	16		- @ 16.15 m: beds become irregular and highly deformed, exhibits minor displacement along fractures, microfolds in some bedding	
60	18		CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle - from 18.90 to 19.20 m: few 13 to 38 mm thick coal seams	18.29
65	20		SANDSTONE Grey, fine grained, becomes finer towards bottom of unit, weakly bedded	19.20 19.81
70			CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle	
	22		SANDSTONE Green to greyish green, very fine grained, some shell fragments	21.64
75			CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle	22.25
	24		End of Borehole	22.86

INSTALLATION DETAILS

Diagram



Description

- 0.671 m Stick-up
- Sand
0 to 0.61 m BGS
- 152 mm diameter
borehole
from 0 to 5.18 m
- Bentonite
- Solid pipe
51 mm diameter
Schedule 40 PVC
- Sand
Sil 9 (4/10)
- Slotted pipe
51 mm diameter
Schedule 40 PVC
No. 10 slot
- 102 mm diameter
borehole
from 5.18 to 22.86 m
- Bentonite

Screen Interval: 8.23 - 11.28 m BGS
Sand Pack Interval: 7.62 - 11.28 m BGS
Well Seal Interval: 0.61 - 7.62 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-5-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

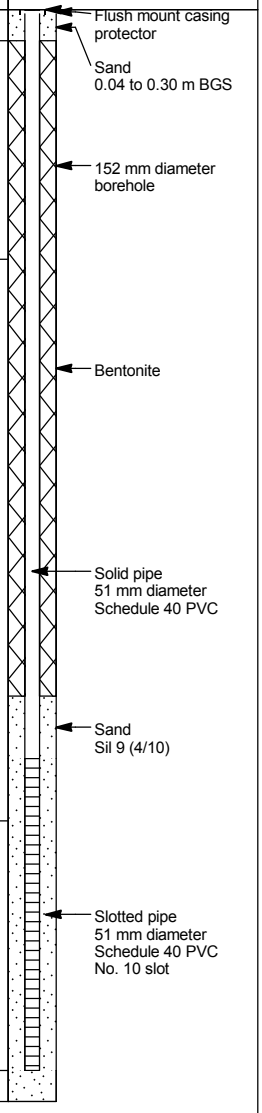
Monitoring Well: MW16-6-11 (GW6S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31100.486
Contractor:	All Service Drilling Inc.	**Northing:**	5658135.293

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			SILT Light brown, some clay, moist to wet	0.30
5	2		- @ 1.22 m: clay content begins to increase	
			SILTY CLAY Light brown to light grey, medium to high plastic, mottled	2.44
10	4			
15			- @ 4.88 m: clay content decreases to 15-30%, high plastic	
20	6			
25				
	8		SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic	7.92
30			- @ 9.14 m: silt content increases to > 40%	
	10			
35			CLAYSTONE Light to medium grey, dry, medium to high plastic when wetted	10.36
			End of Borehole	10.67
	12			

INSTALLATION DETAILS



Screen Interval: 7.32 - 10.36 m BGS
Sand Pack Interval: 6.71 - 10.67 m BGS
Well Seal Interval: 0.30 - 6.71 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-6-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-6-20 (GW6D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31100.423
Contractor:	All Service Drilling Inc.	**Northing:**	5658133.938

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			SILT Light brown, some clay, moist to wet - @ 1.22 m: clay content begins to increase	0.30
5	2			
			SILTY CLAY Light brown to light grey, medium to high plastic, mottled	2.44
10	4			
15			- @ 4.88 m: clay content decreases to 15-30%, high plastic	
20	6			
25				
	8		SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic	7.92
30			- @ 9.14 m: silt content increases to > 40%	
	10			
35			CLAYSTONE - fom 10.36 to 18.90 m: light to medium grey, dry, medium to high plastic when wetted, some small intervals of soft clay fracture gouge throughout	10.36
40	12			
45	14			
50				
	16			
55				
60	18		- from 18.90 to 20.42 m: black to dark grey, dry	
65	20			
			SILTSTONE Light grey, weathered to silt	20.42
70			CLAYSTONE Dark grey, dry	21.34
	22			
75			End of Borehole	22.86
	24			

INSTALLATION DETAILS

Diagram	Description
	Flush mount casing protector
	Sand 0.03 to 0.61 m BGS
	152 mm diameter borehole
	Bentonite seal
	Solid pipe 51 mm diameter Schedule 40 PVC
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 18.90 - 21.95 m BGS
Sand Pack Interval: 18.29 - 22.86 m BGS
Well Seal Interval: 0.61 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-6-20

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-7-5 (GW7)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	28-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31098.792
Contractor:	All Service Drilling Inc.	**Northing:**	5658895.242

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			SILTY CLAY Light to medium brown, moist, medium plastic	0.30
5	2			
10	4			
15			- from 4.57 to 5.18 m: trace fine grained sand, some gravel	
20	6			
			SILTY CLAY (TILL) With very fine to fine grained sand (oxidized), with gravel, dry to moist, low plastic	6.71
25	8			
30			End of Borehole	9.14
	10			

Diagram / Description

- Flush mount casing protector
- Sand 0.05 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval: 2.13 - 5.18 m BGS
Sand Pack Interval: 1.83 - 5.19 m BGS
Well Seal Interval: 0.61 - 1.83 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-7-5

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-8-8 (GW8S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	25-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30875.717
Contractor:	All Service Drilling Inc.	**Northing:**	5659641.119

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		SOIL Black, dry	0.00
			SILT (TILL) Brown to light brown, some gravel, with clay, dry, low plastic, friable	0.30
5	2			
			- @ 2.44 m: some very fine grained sand seams become present	
10	4		- @ 3.35 m: becomes moist	
15	6		- @ 5.79 m: red to orange, trace oxidized silt stringers	
20			SILT AND SAND Brown, very fine grained, saturated	6.71
			SILTY CLAY (TILL) Light to medium brown, with gravel, dry, low plastic	7.01
25	8		End of Borehole	7.92

INSTALLATION DETAILS

Diagram

Description

- 0.516 m Stick-up
- Sand
0 to 0.61 m BGS
- 254 mm diameter
borehole
- Bentonite
- Solid pipe
51 mm diameter
Schedule 40 PVC
- Sand
Sil 9 (4/10)
- Groundwater
6.27 m BGS
May 25, 2016
- Slotted pipe
51 mm diameter
Schedule 40 PVC
No. 10 slot

Screen Interval: 6.10 - 7.62 m BGS
Sand Pack Interval: 5.49 - 7.92 m BGS
Well Seal Interval: 0.61 - 5.49 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-8-8

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-8-19 (GW8D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	25-May-2016 / 26-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30877.454
Contractor:	All Service Drilling Inc.	**Northing:**	5659641.18

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			SOIL Black, dry	0.00 0.30
			SILT (TILL) Brown to light brown, some gravel, with clay, dry, low plastic, friable	
5	2			
			- @ 2.44 m: some very fine grained sand seams become present	
10	4		- @ 3.35 m: becomes moist	
15				
20	6		- @ 5.79 m: red to orange, trace oxidized silt stringers	
			SILT AND SAND Brown, very fine grained, saturated	6.71 7.01
25	8		SILTY CLAY (TILL) Light to medium brown, with gravel, dry, low plastic	
30			SILTSTONE Light brown to beige, dry, friable	8.53
	10		CLAYSTONE Light to medium grey, few fructures	9.45
35			- @ 10.36 m: becomes highly weathered, with abundant fractures, orangish brown clay mineralization along fracture surfaces	
40	12		SILTSTONE Grey to dark grey, finely interbedded light and dark layers, unfractured	11.28
45	14		- @ 14.02 m: thin very fine to fine grained sand layers become present	
50	16			
55			SANDSTONE Medium brown, fine grained, few fractures, minor oxidation and mineralization along fractures	16.76
60	18		CLAY Black, high plastic	18.29 18.59
			SILTSTONE Grey to greenish grey, dry, friable, clay alteration along fracture surfaces	
65	20			
			End of Borehole	20.42
70				

INSTALLATION DETAILS

Diagram

Description

- 0.529 m Stick-up
- Sand, 0 to 0.61 m BGS
- 254 mm diameter borehole from 0 to 8.53 m
- Groundwater, 4.81 m BGS, May 25/26, 2016
- Sand, Sil 9 (4/10)
- Bentonite
- Solid pipe, 51 mm diameter, Schedule 40 PVC
- 102 mm diameter borehole from 8.53 to 20.42 m
- Slotted pipe, 51 mm diameter, Schedule 40 PVC, No. 10 slot
- Bentonite

Screen Interval: 16.46 - 18.59 m BGS
Sand Pack Interval: 16.46 - 18.59 m BGS
Well Seal Interval: 0.61 - 16.46 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-8-19

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-9-6 (GW9)

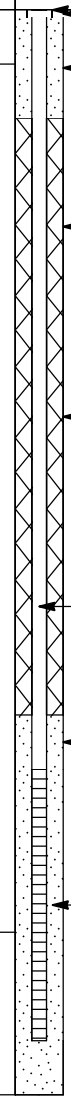
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	02-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30236.405
Contractor:	All Service Drilling Inc.	**Northing:**	5659076.781

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			CLAY Light to medium brown, with silt, moist, high plastic, mottled	0.30
	1			
5				
	2			
	3			
10				
			- below 3.66 m: some seams of very fine grained sand (oxidized)	
	4			
15			- from 4.57 to 5.18 m: silt content increases to > 40%	
	5			
			SILTY CLAY (TILL) with very fine to fine grained sand, with gravel	5.18
	6			
20			End of Borehole	6.10

INSTALLATION DETAILS

Diagram



Description

- Flush mount casing protector
- Sand 0.04 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 4.27 - 5.79 m BGS
Sand Pack Interval: 3.96 - 6.10 m BGS
Well Seal Interval: 0.61 - 3.96 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-9-6

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-10-15 (GW10)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	10-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30461.405
Contractor:	All Service Drilling Inc.	**Northing:**	5658478.167

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
			SILTY CLAY Light to medium brown, moist, medium to high plastic, mottled	0.30
5	2			
10	4		- below 3.66 m: some very fine grained sand, some gravel	
15				
			CLAYEY SILT Light grey to medium brown, moist, high plastic, mottled	5.49
20	6			
25	8			
30				
	10		CLAY (TILL) Medium brown, some very fine grained sand, some gravel, with silt, dry to moist, medium plastic	9.45
35			- @ 10.97 m: gravel content increases to 15-30%	
40	12			
			CLAYEY SILT (TILL) Medium to dark grey, with very fine grained sand, some gravel, dry, low plastic	12.80
45	14			
50			SILTSTONE Light to medium grey, dry	14.94
	16			
55				
	18			
60			End of Borehole	18.29

INSTALLATION DETAILS

Diagram	Description
	0.848 m Stick-up
	Sand 0 to 0.30 m BGS
	152 mm diameter borehole
	Bentonite
	Solid pipe 51 mm diameter Schedule 40 PVC
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
	Bentonite

Screen Interval: 12.19 - 15.24 m BGS
Sand Pack Interval: 11.89 - 18.14 m BGS
Well Seal Interval: 18.14 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-10-15

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-11-15 (GW11)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	30-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30269.84
Contractor:	All Service Drilling Inc.	**Northing:**	5657742.889

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
			CLAY Light to medium brown, with silt, moist, high plastic, mottled	0.30
5	2		- @ 2.13 m: silt content increases to 30-40%, mottled brown and grey	
10	4		- @ 2.74 m: silt content decreases back to 15-30%	
15				
20	6		- @ 5.79 m: clay content begins to decrease towards bottom of interval	
			SILT Medium brown, some clay, moist	6.40
25	8			
			SILT (TILL) Medium brown, with fine to medium grained sand, with gravel, some clay, moist	8.53
30	10			
35				
40	12		SILT Medium brown, some very fine grained sand, moist to wet	12.19
45	14			
			CLAY (TILL) Medium to dark grey, some very fine grained sand, some gravel, with silt, low plastic	14.63
50	16		End of Borehole	15.24

INSTALLATION DETAILS

Diagram

Description

- 0.588 m Stick-up
- Sand
0 to 0.30 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe
51 mm diameter
Schedule 40 PVC
- Sand
Sil 9 (4/10)
- Slotted pipe
51 mm diameter
Schedule 40 PVC
No. 10 slot

Screen Interval: 11.58 - 14.63 m BGS
Sand Pack Interval: 10.97 - 15.24 m BGS
Well Seal Interval: 0.30 - 10.97 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-11-15

Stantec

Drawn By/Checked By: M. Kuhl / D. King

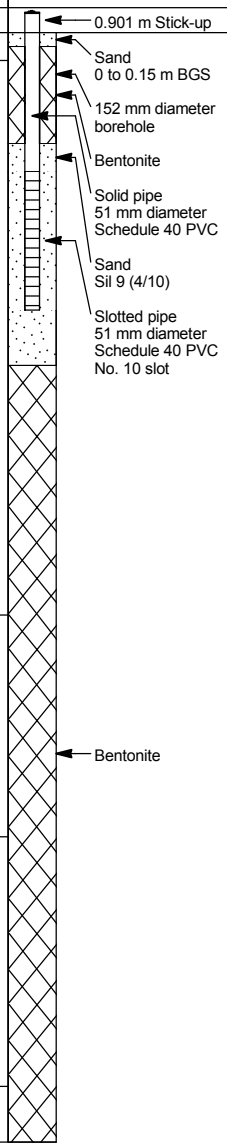
Monitoring Well: MW16-12-3 (GW12)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	19-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29160.284
Contractor:	All Service Drilling Inc.	**Northing:**	5657858.348

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		TOPSOIL	0.00
			CLAYEY SILT (TILL) Medium brown, moist, high plastic	0.30
5	2		- @ 1.83 m: sand content increases to 30-40%, fine to medium grained sand, some gravel	
10	4		- @ 2.74 m: sand content decreases to 15-30%	
15				
20	6		SANDY SILT (TILL) Medium brown, some gravel, with clay, dry to moist, crumbly	6.40
25	8			
30	10		SANDY CLAY (TILL) Medium to dark grey, some silt, dry to moist	8.84
35				
40	12		CLAYSTONE Light grey to brown, dry	11.58
			End of Borehole	12.19

INSTALLATION DETAILS



Screen Interval: 1.52 - 3.05 m BGS
Sand Pack Interval: 1.22 - 3.66 m BGS
Well Seal Interval: 0.15 - 1.22 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-12-3

Stantec

Drawn By/Checked By: M. Kuhl / D. King

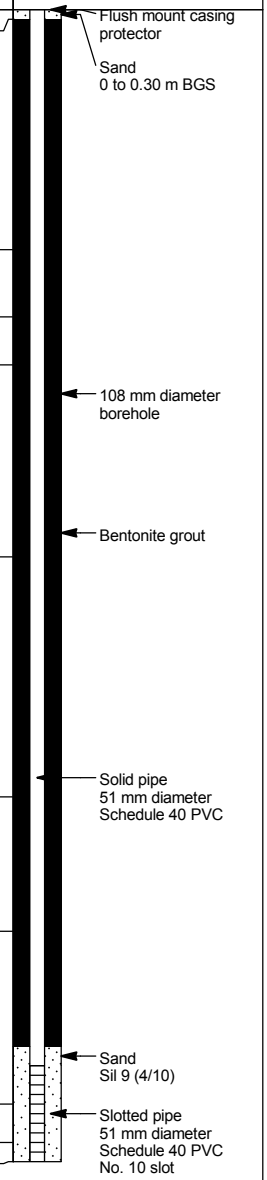
Monitoring Well: MW16-13-37 (GW13)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	08-Aug-2016 / 09-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	n/a
Contractor:	All Service Drilling Inc.	**Northing:**	n/a

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			GRAVEL (FILL)	0.00
5	2		CLAYEY SILT (TILL) Mottled light and medium brown, some very fine grained sand (slightly oxidized), dry to moist, medium plastic	0.30
			- @ 2.13 m: some gravel	
10	4		- @ 3.66 m: sand content increases to 15-30%	
15				
20	6			
25	8		SANDSTONE Very fine to fine grained, dry	7.62
30			- from 9.14 to 9.75 m: saturated	
	10		CLAYSTONE Medium brown, dry	9.75
35			- below 10.36 m: few moist zones weathered to clay	
40	12		SILTSTONE Light grey, dry, friable	11.28
			- @ 12.80 m: saturated	
45	14			
50				
	16			
55				
60	18		CLAYSTONE Medium grey to brown, some zones weathered to clay, other zones dry, friable	17.37
65	20		- below 20.12 m: dry	
70				
	22			
75				
80	24			
85	26		SILTSTONE Light to medium grey, in some zones fractured and weathered to silt	24.99
90				
95	28			
100	30		CLAYSTONE Light to medium grey, dry, some fractured and weathered zones	29.26
105	32		below 31.70 m: completely dry	
110				
	34			
115			SILTSTONE Light grey, saturated	34.75
	36		CLAYSTONE Light to medium grey	35.97
120			End of Borehole	36.58
125	38			

INSTALLATION DETAILS



Screen Interval: 33.53 - 36.58 m BGS
Sand Pack Interval: 32.92 - 36.58 m BGS
Well Seal Interval: 0.30 - 32.92 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114

Stantec

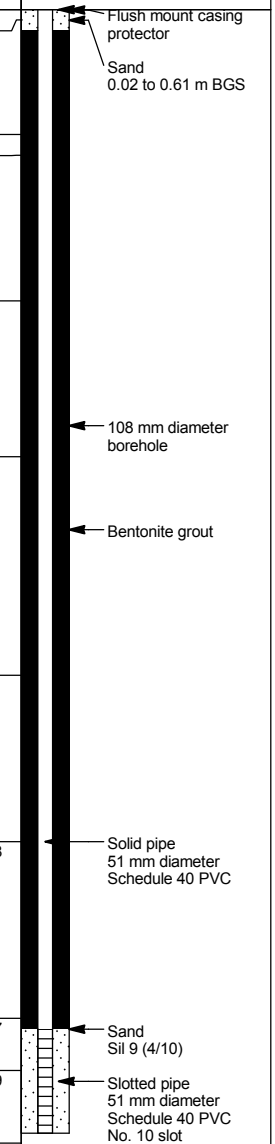
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-14-33 (GW14)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	09-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-28592.189
Contractor:	All Service Drilling Inc.	**Northing:**	5659018.428

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			GRAVEL	0.00
5	2		CLAYEY SILT (TILL) Brown, some very fine grained sand, moist, medium plastic	0.30
10				
	4		SANDSTONE Light to medium brown, very fine grained sand, dry	3.66
15				4.27
20	6		CLAYSTONE Medium grey, dry	
25	8			
30			SANDSTONE Light to medium brown, very fine to fine grained	8.53
35	10			
40	12			
45	14		SILTSTONE Light grey, dry	13.11
50				
55	16			
60	18			
65	20		CLAYSTONE Medium grey to brown, dry	19.51
70				
75	22			
80	24		SILTSTONE Medium brown, saturated	24.38
85	26			
90				
95	28			
100	30		CLAYSTONE Light to medium grey	29.57
105	32		SILTSTONE Light to medium grey, saturated	31.09
110	34		CLAYSTONE Light to medium grey	33.22
115	36		End of Borehole	33.53



Screen Interval: 29.88 - 32.93 m BGS
Sand Pack Interval: 29.87 - 32.93 m BGS
Well Seal Interval: 0.61 - 29.87 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-14-33

Stantec

Drawn By/Checked By: M. Kuhl / D. King

STANTEC BOREHOLE AND WELL V2 110773396_NEW.GPJ STANTEC - DATA TEMPLATE.GDT 17/1/16 MKUHL

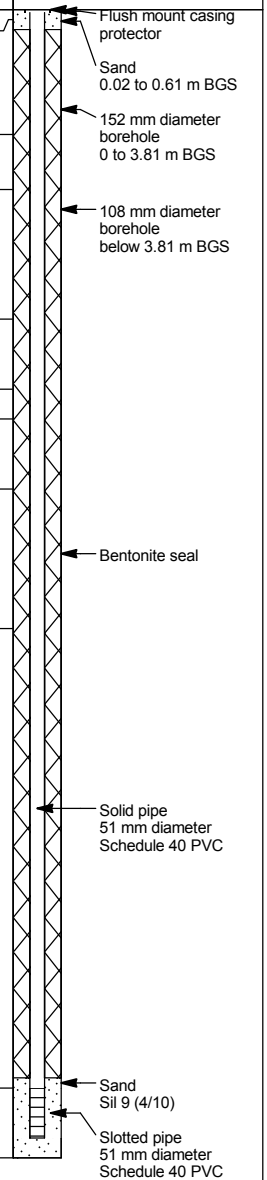
Monitoring Well: MW16-15-34 (GW15)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem/ air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	27-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-27818.819
Contractor:	All Service Drilling Inc.	**Northing:**	5658214.931

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
5	2		SILTY CLAY (TILL) Beige to light brown, moist, medium plastic - @ 1.83 m: some very fine grained sand stringers, some gravel	0.30
10	4		SILTSTONE Light beige, dry	3.81
15	6		SANDSTONE Light brown, very fine grained, dry	5.49
20	8			
25	10		SILTSTONE Light beige, dry, few thin sandstone layers throughout	9.45
30	12		CLAYSTONE Medium grey, dry	11.58
35	14		SANDSTONE Light brown, very fine to fine grained, dry	12.50
40	16		SILTSTONE Light grey to light brown, dry - from 15.85 to 17.07 m: few seams of fine grained sand (oxidized)	14.63
45	18			
50	20		CLAYSTONE Medium to dark grey, dry	18.90
55	22			
60	24			
65	26		- below 26.82 m: some siltstone layers	
70	28			
75	30			
80	32		- @ 31.09 m: light grey	
85	34		SILTSTONE Light to medium greenish grey - 32.92 m: saturated	32.92
90	36		End of Borehole	35.05

INSTALLATION DETAILS



Screen Interval: 32.92 - 34.44 m BGS
Sand Pack Interval: 32.61 - 35.05 m BGS
Well Seal Interval: 0.61 - 32.61 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-15-34

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-16-11 (DC-9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	15-Apr-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-33453.625
Contractor:	All Service Drilling Inc.	**Northing:**	5655154.279

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			SOIL Some clay, organics	0.00
			SILT Brown to beige, minor very fine sand, some clay	0.30
			CLAY Mottled beige to grey, minor silt, moist	1.52
			CLAY (TILL) Some fine to very fine grained sand, some gravel, some silt, dry, friable	5.18
			SANDSTONE Very fine grained, dry, weathered, crumbles under minor force	10.36
			End of Borehole	10.97

Diagram / Description:

- 0.914 m Stick-up
- Sand, 0 to 0.30 m BGS
- 254 mm diameter borehole from 0 to 10.36 m
- Bentonite
- Solid pipe, 51 mm diameter, Schedule 40 PVC
- Sand, Sil 9 (4/10)
- Slotted pipe, 51 mm diameter, Schedule 40 PVC, No. 10 slot
- 102 mm diameter borehole from 10.36 to 10.97 m

Screen Interval: 7.62 - 10.67 m BGS
Sand Pack Interval: 7.01 - 10.97 m BGS
Well Seal Interval: 0.30 - 7.01 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-16-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

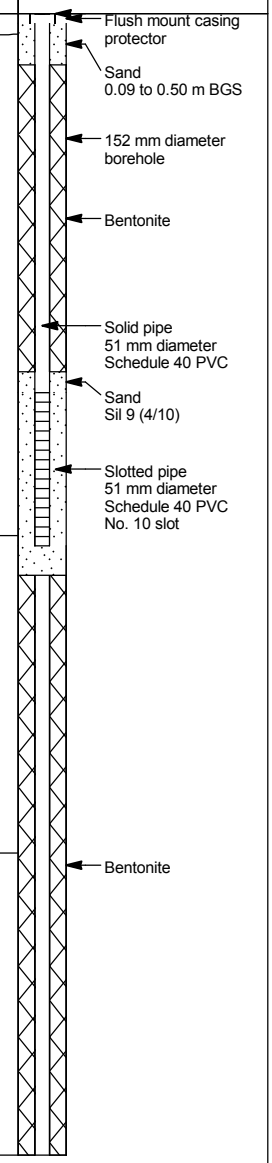
STANTEC BOREHOLE AND WELL V2 110773396_NEW.GPJ STANTEC - DATA TEMPLATE.GDT 17/1/16 MKUHL

Monitoring Well: MW16-17-5 (DC-15)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-33226.452
Contractor:	All Service Drilling Inc.	**Northing:**	5656140.553

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			CLAY Mottled brown - from 0.2 to 2.5 m: minor silt, damp to moist, low to medium plastic	0.20
5	2		- from 2.5 to 5.1 m: minor sand, some silt, moist, medium plastic	
10	4			
15				
	6		SILTY CLAY (TILL) Minor sand, trace gravel, damp, some oxidation	5.10
20				
25	8		SILT Brown, minor fine grained sand, trace gravel, some clay, moist	8.20
30				
35	10			
	12		End of Borehole	11.15



Screen Interval: 3.70 - 5.20 m BGS
Sand Pack Interval: 3.50 - 5.49 m BGS
Well Seal Interval: 5.49 - 11.15 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-17-5

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-18-6 (DC-21S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32406.586
Contractor:	All Service Drilling Inc.	**Northing:**	5656749.506

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Diagram	Description
			Ground Surface			0.816 m Stick-up
0	0		SILTY CLAY (TILL) Brown, minor sand, moist, low plastic	0.00		Sand 0 to 0.30 m BGS
	1					152 mm diameter borehole
5						
	2					Bentonite
10	3					Solid pipe 51 mm diameter Schedule 40 PVC
			SANDY CLAY	3.50		Sand Sil 9 (4/10)
	4					
15			- from 4.8 to 4.9 m: rafted bedrock			Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
	5		SAND AND SILT Light brown, medium grained, some gravel, moist	5.10		
	6					Bentonite
20			End of Borehole	6.10		

Screen Interval: 3.97 - 5.49 m BGS
Sand Pack Interval: 3.50 - 5.64 m BGS
Well Seal Interval: 5.64 - 6.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-18-6

Stantec

Drawn By/Checked By: M. Kuhl / D. King

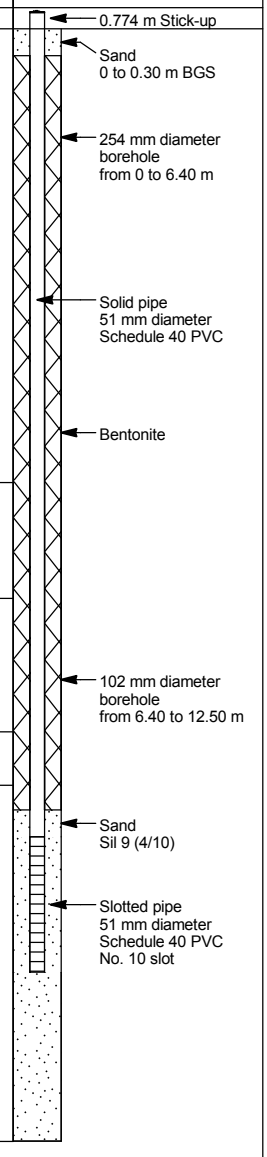
Monitoring Well: MW16-18-10 (DC-21D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32406.714
Contractor:	All Service Drilling Inc.	**Northing:**	5656750.577

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		SILTY CLAY (TILL) Brown, minor sand, moist, low plastic	0.00
5	2			
10	4		- beginning @ 3.5 m: becomes sandy clay	
15			- from 4.8 to 4.9 m: rafted bedrock	
			SAND AND SILT Light brown, medium grained, some gravel, moist	5.10
20	6			
			SILTSTONE Grey to greenish, some fractures, oxidation along fractures	6.40
25				
	8		SANDSTONE Grey to greenish, very fine grained, few fractures, oxidation on fratures surfaces	7.90
			CLAYSTONE - from 8.5 to 8.63 m: brown, minor silt, moist, weathered to soft clay - from 8.63 to 12.5 m: grey, oxidized fractures	8.50
30			- @ 9.24 m: fracture intensity increases	
	10		- from 9.65 to 10.9 m: highly fractured, oxidation and some clay along fractures	
35			- from 10.36 to 10.63 m: altered to clay	
40	12		- @ 12.10 m: becomes hard/cemented	
			End of Borehole	12.50
45				

INSTALLATION DETAILS



Screen Interval: 9.08 - 10.60 m BGS
Sand Pack Interval: 8.78 - 12.50 m BGS
Well Seal Interval: 0.30 - 8.78 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-18-10

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-19-8 (DC-25S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger
Client:	Alberta Transportation	**Date started/completed:**	09-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31684.576
Contractor:	All Service Drilling Inc.	**Northing:**	5657262.245

SUBSURFACE PROFILE				INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Diagram / Description
0	0		Ground Surface		0.925 m Stick-up
			TOPSOIL	0.00	Sand 0 to 0.30 m BGS
			SILTY CLAY (TILL) Light to medium brown, some very fine grained sand, some gravel, few lenses of oxidized silt, moist, low plastic	0.61	
5	2				152 mm diameter borehole
10	4				Bentonite
					Solid pipe 51 mm diameter Schedule 40 PVC
15					
20	6				Sand Sil 9 (4/10)
			SANDY SILT Medium brown, very fine grained, wet	6.40	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
25	8		End of Borehole	7.62	

Screen Interval: 6.10 - 7.62 m BGS
Sand Pack Interval: 5.79 - 7.62 m BGS
Well Seal Interval: 0.30 - 5.79 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-19-8

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-19-19 (DC-25D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	08-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31684.489
Contractor:	All Service Drilling Inc.	**Northing:**	5657263.177

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
			SILTY CLAY (TILL) Light to medium brown, some very fine grained sand, some gravel, few lenses of oxidized silt, moist, low plastic	0.61
10	2			
			- @ 3.66 m: gravel content increases to 15-30%	
20	6			
			SANDY SILT Medium brown, very fine grained, wet	6.40
30	10			
			SANDSTONE Light to medium brown, very fine to fine grained, few fractures, reddish orange oxidation	10.36
40	12		- @ 12.50 m: becomes grey, few thin black stringers and minor cross-bedding	
			CLAYSTONE Medium to dark grey, highly fractured, few 150 to 300 mm thick intervals of clay alteration in zones of intense fracturing	13.11
50	16		- @ 15.54 m: 300 mm thick interval of green to greyish siltstone, minor bioturbation, few shell fragments	
55			- @ 16.76 m: 150 mm thick seam of anthracite present	
			SANDSTONE Green to greyish, very fine to fine grained, planar bedding, few fractures, no oxidation	17.07
60	18			
			CLAYSTONE Medium grey to dark grey, highly fractured, clay alteration along fractures, friable	18.59
70	22		- @ 21.64 m: becomes hard and cohesive, few fractures	
75				
			End of Borehole	23.16
80	24			

INSTALLATION DETAILS

Diagram	Description
	0.913 m Stick-up
	Sand 0 to 0.61 m BGS
	254 mm diameter borehole from 0 to 10.36 m BGS
	Groundwater 6.57 m BGS June 08, 2016
	Bentonite seal
	102 mm diameter borehole from 10.36 to 23.16 m
	Solid pipe 51 mm diameter Schedule 40 PVC
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
	Bentonite

Screen Interval: 17.07 - 18.59 m BGS
Sand Pack Interval: 16.76 - 18.67 m BGS
Well Seal Interval: 0.61 - 16.76 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-19-19

Stantec

Drawn By/Checked By: M. Kuhl / D. King

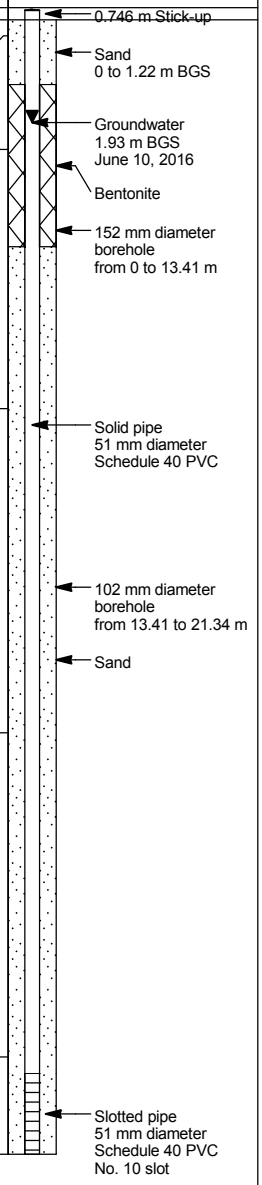
Monitoring Well: MW16-20-21 (D2)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger
Client:	Alberta Transportation	**Date started/completed:**	10-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31218.384
Contractor:	All Service Drilling Inc.	**Northing:**	5657498.57

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
			SILTY CLAY Light brown, moist, medium plastic	0.30
5	2			
			SILTY CLAY (TILL) Mottled brown and grey, with very fine sand lenses (tend to be orangish brown and oxidized), with gravel, moist	2.44
10	4			
15				
20	6			
			SILT Medium brown, with clay, moist, crumbly	7.32
25	8			
30			- @ 9.45 m: beige, begins to contain some very fine sand lenses (150 mm thick) and some gravel, dry	
35	10			
			- @ 11.58 m: silt becomes dark brown to grey	
40	12			
45	14		SILTSTONE Medium to dark grey, highly fractured, edges of large fractures have been weathered to silt, smaller fractures exhibit oxidation	13.41
50	16			
55				
60	18			
65	20		SANDSTONE Grey to dark grey, very fine to fine grained, with weak cross-bedding, few fractures	19.51
70	22		End of Borehole	21.34
75				

INSTALLATION DETAILS



Screen Interval: 19.81 - 21.34 m BGS
Sand Pack Interval: 4.27 - 21.34 m BGS
Well Seal Interval: 1.22 - 4.27 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-20-20

Stantec

Drawn By/Checked By: M. Kuhl / D. King

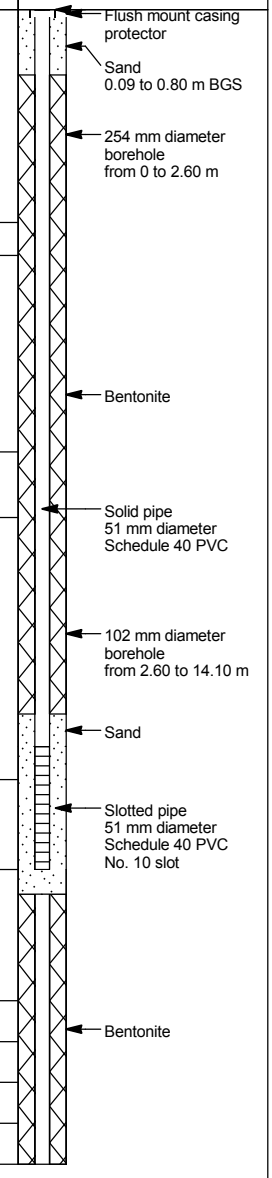
Monitoring Well: MW16-21-11 (D9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	01-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30383.805
Contractor:	All Service Drilling Inc.	**Northing:**	5656987.083

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			OVERBURDEN	0.00
5	2			
			SANDSTONE Coarse grained, weathered, few fractures	2.60
10			MUDSTONE AND CLAYSTONE Interbedded, massive - mudstone: brown, friable, has been weathered to clay along fractured - claystone: grey to light grey, with minor fractures, oxidation on fractures	3.00
15	4			
			SANDSTONE Grey to brown, fine grained, well defined cross-bedding	5.40
20	6			
			SILTSTONE Grey to brown, highly fractured and weathered, portions are highly friable and weathered to clay	6.20
25	8			
30				
			SANDSTONE Grey to brown, medium grained, planar laminated, competent core	9.40
35	10			
			SILTSTONE Highly fractured with weathering to silt along fractures	10.50
40	12			
			SANDSTONE Fine grained, finely cross-bedded, few fractures with oxidation along fracture surfaces	12.10
			SILTSTONE Grey, highly fractured and weathered	12.60
			SANDSTONE Fine grained, finely cross-bedded, few fractures	13.10
45	14		SILTSTONE Highly fractured and friable	13.60
			End of Borehole	14.10

INSTALLATION DETAILS



Screen Interval: 9.00 - 10.50 m BGS
Sand Pack Interval: 8.60 - 10.80 m BGS
Well Seal Interval: 10.80 - 14.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-21-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-22-26 (D27)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	21-Jul-2016 / 22-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29330.853
Contractor:	All Service Drilling Inc.	**Northing:**	5656907.343

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		~~Ground Surface~~	
			TOPSOIL	0.00
5	2		CLAY - from 0.61 to 2.44 m: beige to light brown, with silt, moist, high plastic	0.61
10	4		- from 2.44 to 10.06 m: medium brown, trace fine grained sand, trace gravel, some silt, medium plastic	
15				
20	6			
25	8			
30	10			
35			SILTY CLAY Medium brown, some very fine grained sand, trace gravel, medium plastic, minor oxidation within sand stringers - @ 11.28 m: sand content increases to 15-30%, gravel content increases to 5-15%	10.06
40	12		SANDY SILT Medium brown, with gravel, dry to moist, friable	11.28
45	14			
50				
	16		- below 15.85 m: dry	
55				
60	18		SANDY SILT (TILL) Medium to dark grey, some gravel, with clay, dry, medium plastic	17.68
65	20			
70			SILTY CLAY (TILL) Dark grey, with gravel, dry to moist, medium plastic	20.73
	22			
75				
80	24			
85	26		SILTSTONE Light to medium grey	25.91
90			End of Borehole	27.43
	28			
95				
	30			

Diagram	Description
	~~0.917 m Stick-up~~
	Sand 0 to 0.15 m BGS
	152 mm diameter borehole
	Bentonite
	Solid pipe 51 mm diameter Schedule 40 PVC
	Groundwater Level 22.15 m BTOC July 22, 2016
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 22.86 - 25.91 m BGS
Sand Pack Interval: 22.56 - 27.43 m BGS
Well Seal Interval: 0.15 - 22.56 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-22-26

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-23-14 (D36S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	24-Jul-2016 / 25-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29019.682
Contractor:	All Service Drilling Inc.	**Northing:**	5657309.567

SUBSURFACE PROFILE				INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Diagram / Description
0	0		Ground Surface		0.855 m Stick-up
			TOPSOIL	0.00	
			CLAY Light to medium brown, trace very fine grained sand, some silt, moist, medium plastic	0.30	Sand 0 to 0.61 m BGS
5	2				
10	4				152 mm diameter borehole
15					
			SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist	4.88	
20	6				Bentonite
25	8				
30					Solid pipe 51 mm diameter Schedule 40 PVC
35	10				
40	12		SILT Light brown, trace very fine grained sand, moist	12.19	Sand Sil 9 (4/10)
			- @ 13.41 m: becomes wet		Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
45	14		CLAY Low plastic - from 13.72 to 14.02 m: some silt	13.72	
			End of Borehole	14.00	

Screen Interval: 12.48 - 14.00 m BGS
Sand Pack Interval: 12.17 - 14.00 m BGS
Well Seal Interval: 0.61 - 12.17 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-23-14

Stantec

Drawn By/Checked By: M. Kuhl / D. King

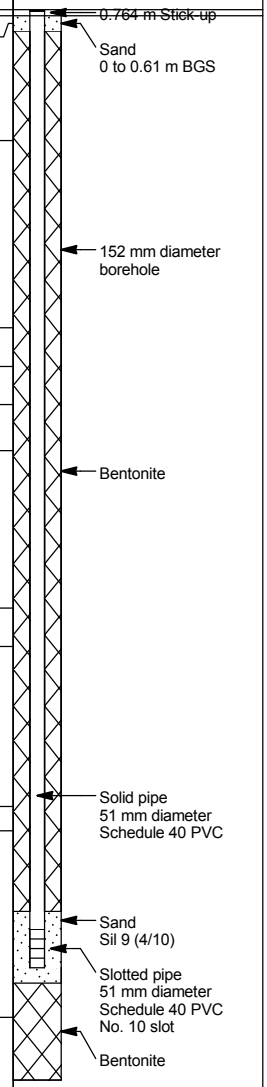
Monitoring Well: MW16-23-36 (D36D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	24-Jul-2016 / 25-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29019.349
Contractor:	All Service Drilling Inc.	**Northing:**	5657308.346

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
5	2		CLAY Light to medium brown, trace very fine grained sand, some silt, moist, medium plastic	0.30
10	4			
15				
20	6		SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist	4.88
25	8			
30	10			
35				
40	12		SILT Light brown, trace very fine grained sand, moist	12.19
45	14		- @ 13.41 m: becomes wet	13.72
50			CLAY Low plastic	15.24
55	16		- from 13.72 to 14.02 m: some silt - from 14.02 to 15.20 m: light grey, dry to damp, mottled	
60	18		SANDSTONE Medium brown, highly fractured	17.00
65	20		CLAYSTONE Grey, highly fractured, clay fracture gouge present	
70				
75	22			
80	24		SANDSTONE Medium brown to grey	23.15
85	26		SILTSTONE Grey, some oxidation on fractured surfaces	24.65
90				
95	28		- from 28.05 to 28.45 m: highly fractured - below 28.45 m: some bedding present	
100	30			
105	32		SANDSTONE Grey, fine grained	30.90
110			MUDSTONE Grey to dark grey, fractured	31.85
115	34			
120	36			
125	38			
130	40		SILTSTONE Grey, fractured	39.15
135			- from 41.05 to 41.65 m: some bedding	
140	42			
145	44		MUDSTONE Grey, fractured	42.55
150	46			
155			End of Borehole	45.72
	48			

INSTALLATION DETAILS



Screen Interval: 35.70 - 37.20 m BGS
Sand Pack Interval: 35.00 - 37.80 m BGS
Well Seal Interval: 0.61 - 35.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-23-36

Stantec

Drawn By/Checked By: M. Kuhl / D. King

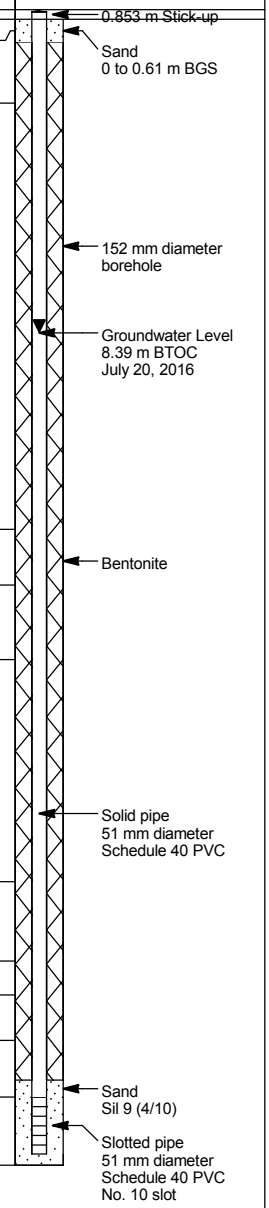
Monitoring Well: MW16-24-30 (D51)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger / Coring
Client:	Alberta Transportation	**Date started/completed:**	19-Jul-2016 / 20-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-28761.753
Contractor:	All Service Drilling Inc.	**Northing:**	5657740.483

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
5	2		SILT With sand, trace gravel, dry to damp	0.30
10	4		CLAY Medium brown, trace sand and gravel, low plastic, minor oxidation, mottled	2.25
15				
20	6			
25	8			
30				
	10			
35				
40	12		- @ 11.9 m: becomes sandy	
45	14		SAND Some gravel, some clay, dry, oxidized	13.70
50			SILTSTONE Light to medium grey, areas with high fracture intensity, some oxidation along larger fractures	15.20
55	16			
60	18		SANDSTONE Brown to grey, planar bedded	17.20
65				
	20			
70				
	22			
75			SILTSTONE Light to medium grey, areas with high fracture intensity, some oxidation along larger fractures - below 24.08 m: fine planar laminations - below 24.69 m: grainsize begins to decrease towards bottom of interval	23.16
80	24			
85	26		CLAYSTONE Dark to medium grey, some fracturing, minor weathering along fractures	25.30
			SILTSTONE Light to medium grey, highly fractured, faint laminations and cross-bedding - below 27.13 m: some lenses of very fine grained sandstone	26.21
90	28		CLAYSTONE Medium grey, highly fractured and weathered to clay throughout interval	27.43
95			SANDSTONE Medium grey, very fine to fine grained, competent, few fractures	28.96
100	30			
105	32		End of Borehole	30.78

INSTALLATION DETAILS



Screen Interval: 28.96 - 30.48 m BGS
Sand Pack Interval: 28.50 - 30.78 m BGS
Well Seal Interval: 0.61 - 28.50 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-24-30

Stantec

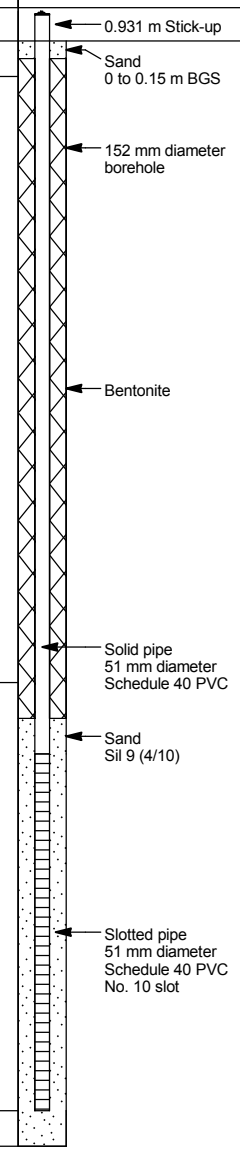
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-25-9 (BS3)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	19-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29274.736
Contractor:	All Service Drilling Inc.	**Northing:**	5658230.981

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		TOPSOIL	0.00
			SILTY CLAY Light to medium brown, moist, medium plastic, some mottling	0.30
5	2			
			- @ 2.74 m: silt content decreases to 15-30%	
10	4			
15			- @ 4.88 m: silt content increases to > 40% - below 5.18 m: trace gravel	
			SILT AND CLAY (TILL) Medium brown, some very fine grained sand, some gravel, moist, medium plastic	5.49
20	6			
25	8			
30			CLAYSTONE Light grey to brown, dry	9.14
	10		End of Borehole	9.45



Screen Interval: 6.10 - 9.14 m BGS
Sand Pack Interval: 5.79 - 9.45 m BGS
Well Seal Interval: 0.15 - 5.79 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-25-9

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-26-18 (H6)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32702.727
Contractor:	All Service Drilling Inc.	**Northing:**	5659178.128

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			CLAY Light to medium brown, with silt, moist, high plastic, mottled	0.30
5	2		SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic	1.83
10	4			
15				
20	6			
			SAND AND SILT Medium brown, very fine grained, moist - @ 7.32 m: saturated	6.71
25	8			
			CLAY (TILL) Dark grey, with very fine grained sand, with gravel, with silt, dry to moist, low to medium plastic	8.23
30	10			
35				
40	12			
45	14			
50			CLAYSTONE Grey, dry, crumbly	15.24
55	16			
			- from 17.37 to 17.98 m: fractured, saturated interval	
60	18		End of Borehole	18.29

INSTALLATION DETAILS

Diagram / Description

- Flush mount casing protector
- Sand 0.05 to 0.30 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 15.85 - 18.29 m BGS
Sand Pack Interval: 15.54 - 18.29 m BGS
Well Seal Interval: 0.30 - 15.54 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-26-18

Stantec

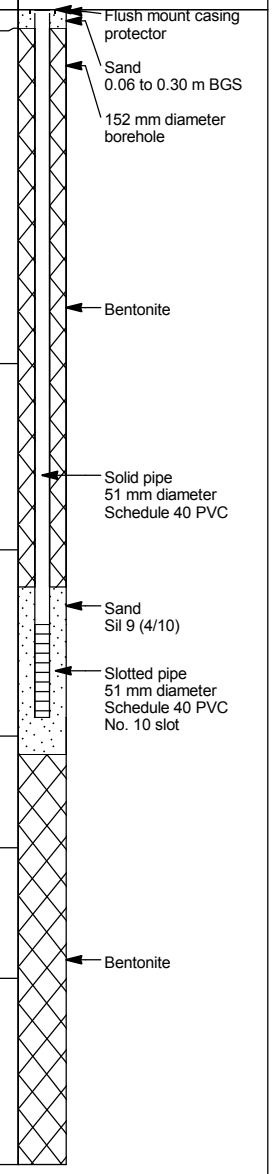
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-27-12 (H9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32702.328
Contractor:	All Service Drilling Inc.	**Northing:**	5659766.161

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
			TOPSOIL	0.00
			SILTY CLAY Light to medium brown, moist, high plastic, mottled	0.30
5	2			
10	4		- @ 2.74 m: silt content increases to > 40%	
15				
20	6		CLAY (TILL) Some gravel, with silt, moist, high plastic	5.79
25	8			
30			SAND AND SILT Medium brown, very fine grained, moist	8.84
	10			
35			- @ 10.36 m: saturated	
40	12		SILT (TILL) Medium brown, with very fine grained sand, with gravel, with clay, dry to moist, medium plastic	11.89
45	14		CLAY (TILL) Dark grey, with sand, with gravel, with silt, dry to moist, medium plastic	13.72
50				
	16		CLAYSTONE Light grey, dry, some zones are highly fractured and saturated, crumbly	15.85
55				
60	18			
65	20		End of Borehole	18.90



Screen Interval: 10.06 - 11.58 m BGS
Sand Pack Interval: 9.45 - 12.19 m BGS
Well Seal Interval: 0.30 - 9.45 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-27-9

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Attachment B WATER WELL DRILLING RECORDS

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
388990	8/24/1984	Domestic	25	SW	01	025	04	5	
388992	5/17/1989	Stock	46	SW	01	025	04	5	
354359	10/27/1987	Domestic & Stock	37	SE	02	025	04	5	
367130	10/3/1992	Domestic	49	NW	02	024	04	5	
387552		Domestic	87	NW	02	024	04	5	
351158	4/16/1990	Stock	122	SE	03	025	04	5	
351159	4/17/1990	Domestic	49	SW	03	025	04	5	
376489	12/17/1993	Domestic & Stock	11	SE	03	024	04	5	Yes
376490	11/26/1993	Stock	30	SE	03	024	04	5	
387554		Domestic	37	SE	03	024	04	5	
387560	9/18/1979	Domestic & Stock	6	SW	03	024	04	5	
387562	11/18/1974	Stock	11	NE	03	024	04	5	
387563		Domestic	12		03	024	04	5	
389012		Domestic	9	NW	03	025	04	5	
400351	11/4/1994	Domestic & Stock	24	SW	03	024	04	5	
493333	8/1/1995	Domestic	18	SW	03	024	04	5	
1475877	4/12/2007	Stock	37	11	03	025	04	5	
1635033	7/1/2003	Domestic	64	SE	03	024	04	5	
2056009	8/19/2006	Domestic & Stock	20	SW	03	024	04	5	
341648	11/4/2002	Domestic	30	SW	04	025	03	5	
341649	11/4/2002	Domestic	43	SW	04	025	03	5	
350571	3/21/1990	Domestic & Stock	69	NE	04	025	04	5	
494769	10/22/1998	Municipal	127	SW	04	025	03	5	
495256	12/21/1999	Domestic	43	SE	04	025	04	5	
497692	4/18/2001	Other	37	SW	04	025	03	5	
497695	4/18/2001	Other	37	SW	04	025	03	5	
497696	4/17/2001	Other	37	SW	04	025	03	5	
497697	4/17/2001	Other	37	SW	04	025	03	5	
497700	4/11/2001	Other	37	SW	04	025	03	5	
1600057	12/12/2005	Industrial	49	02	04	025	03	5	
388376	5/29/1977	Municipal	139	03	05	025	03	5	
351509	12/15/1989	Domestic	42	SE	06	025	03	5	
376491	12/2/1993	Stock	43	01	06	025	03	5	
387564	5/22/1980	Other	31	NE	06	024	04	5	
388387	10/5/1983	Stock	24	01	06	025	03	5	
388388	8/7/1978	Domestic	37	04	06	025	03	5	
388393	4/13/1989	Domestic	73	SW	06	025	03	5	
416380		Domestic	61	SH	06	025	03	5	
416381		Domestic	79	SH	06	025	03	5	
1020001	2/6/2004	Domestic	40	NW	06	024	03	5	
1020653	2/5/2004	Domestic	37	NW	06	024	03	5	
1021011	2/6/2004	Domestic	40	NW	06	024	03	5	
369196	4/22/1993	Domestic	55	NW	07	024	03	5	
499366	11/13/2001	Domestic	61	SW	07	024	03	5	
379655	6/4/1995	Domestic	49	SE	08	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
379659	6/2/1995	Domestic	50	NE	08	024	03	5	
387566	9/26/1978	Domestic	56	NE	08	024	04	5	
494536	11/25/1998	Stock	15	15	08	024	04	5	
353413	11/29/1989	Domestic	59	NE	09	024	03	5	
359891	9/10/1991	Domestic	36	SE	09	024	03	5	Yes
364585	4/1/1992	Domestic	37	NW	09	024	03	5	
369197	12/9/1992	Domestic	46	SW	09	024	03	5	
379663	6/6/1995	Domestic	47	SW	09	024	03	5	
388300	9/5/1989	Domestic & Stock	59	SE	09	024	03	5	Yes
388301	12/3/1988	Domestic & Stock	37	NW	09	024	03	5	
467140	7/7/1997	Domestic	50	SE	09	024	03	5	Yes
341639	8/29/2002	Domestic	43	SE	10	024	04	5	
387571		Domestic	126		10	024	04	5	
388302		Domestic	43	SE	10	024	03	5	
390430	9/17/1994	Domestic	49	SE	10	024	04	5	
469216	10/14/1997	Domestic	46	NW	10	024	04	5	Yes
1022404	10/15/2013	Domestic	9	7	10	24	3	5	
1063104	10/15/2002	Domestic	5	NE	10	024	04	5	
1245221	11/13/2006	Other	49	16	10	024	04	5	
2022507	5/1/2004	Domestic	30	06	10	024	03	5	
363238	8/27/1985	Domestic & Stock	72	NE	11	024	03	5	
387573	5/18/1979	Domestic	49	SW	11	024	04	5	
388311	9/5/1976	Domestic	21	NW	11	024	03	5	
388314	6/2/1986	Domestic & Stock	41	NE	11	024	03	5	
2093209	3/17/1978	Domestic	91	11	11	24	4	5	
2093209	6/10/1977	Domestic	61	11	11	24	4	5	
2093210	3/17/1978	Domestic	30	11	11	24	4	5	
402461	3/28/1995	Domestic	44	SW	12	024	04	5	
1465013	9/6/2003	Domestic	37	NW	12	024	04	5	
361022	10/17/1991	Domestic	47	SE	13	024	04	5	
367657	10/4/1992	Domestic & Stock	43	NE	13	024	04	5	Yes
387576		Domestic	27	SE	13	024	04	5	
387577		Domestic	27	SE	13	024	04	5	
387578		Domestic	30	SE	13	024	04	5	
1020654	2/4/2005	Domestic	49	SE	13	024	05	5	
353979	6/4/1990	Domestic & Stock	62	SW	15	024	04	5	
363921	3/16/1992	Industrial	5	SW	15	024	03	5	
363922	3/13/1992	Industrial	5	SW	15	024	03	5	
363924	3/11/1992	Industrial	5	SW	15	024	03	5	
363925	3/9/1992	Industrial	6	SW	15	024	03	5	
387696	7/24/1980	Stock	13	SW	15	024	04	5	
387697		Stock	21	NW	15	024	04	5	
387699	3/21/1984	Stock	46	NE	15	024	04	5	
388435		Domestic	120	SE	15	024	03	5	
388438	12/13/1983	Domestic	31	SE	15	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
388440		Domestic	41	SW	15	024	03	5	
388441		Domestic	37	SW	15	024	03	5	
388446		Domestic	40	SW	15	024	03	5	
388450		Domestic	40	SW	15	024	03	5	
388451		Domestic	38	SW	15	024	03	5	
388453		Domestic	0	NW	15	024	03	5	
497689	9/8/2000	Domestic	37	SW	15	024	04	5	
499238	8/22/1988	Stock	24	SW	15	024	04	5	
1020689	6/29/2004	Domestic	37	NW	15	024	04	5	
1020693	6/28/2004	Domestic	29	NW	15	024	04	5	
1021654	2/21/2008	Domestic	59	NE	15	024	04	5	
341366	9/15/2000	Domestic	41	NE	16	024	04	5	
349833	11/16/1995	Domestic	46	NE	16	024	03	5	
355935	3/14/1991	Domestic	61	09	16	024	03	5	
359639	6/4/1991	Domestic	26	16	16	024	03	5	
367030	11/18/1992	Domestic	30	NW	16	024	03	5	
369971	8/23/1993	Domestic	37	NE	16	024	03	5	
387701	10/22/1985	Stock	46	NE	16	024	04	5	
388454		Domestic	32	SE	16	024	03	5	
388456		Domestic	32	NE	16	024	03	5	
388458		Domestic	37	NE	16	024	03	5	
388859		Domestic	34	NE	16	024	03	5	
388860	9/7/1989	Domestic	30	NE	16	024	03	5	
388861	9/8/1989	Domestic	30	NE	16	024	03	5	
467154	5/9/1997	Domestic	15	NE	16	024	04	5	
469207	9/22/1997	Domestic	30	NW	16	024	03	5	
469208	10/24/1997	Domestic	38	SW	16	024	03	5	
494768	10/16/1999	Domestic	43	10	16	024	03	5	
1115001	9/11/2003	Domestic	32	NW	16	024	03	5	
1555506	8/1/2004	Domestic	100	SW	16	024	03	5	
2095354		Stock	0	NE	16	24	4	5	
349532	4/15/1985	Domestic	76	NE	17	024	04	5	
379295	6/1/1995	Domestic	61	SE	17	024	03	5	
387703	4/15/1985	Unknown	76	NE	17	024	04	5	
388862	5/14/1979	Domestic & Stock	40	SE	17	024	03	5	
388866		Domestic	43	NW	17	024	03	5	
388867		Stock	43	NE	17	024	03	5	
390220	11/17/1978	Domestic	31	NE	17	024	03	5	
390238	7/9/1979	Domestic	5	SE	17	024	03	5	
401162	9/21/1994	Domestic	79	NW	17	024	04	5	
1021210	6/28/2006	Domestic	29	NW	17	024	04	5	
1022347	5/17/2013	Domestic	35	1	17	24	3	5	
364586	4/18/1992	Domestic	34	SW	18	024	03	5	
388870		Domestic	15	SW	18	024	03	5	
388871		Domestic	15	SW	18	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
388872	4/18/1977	Domestic	49	SW	18	024	03	5	
1610684	8/19/2011	Municipal	7	8	18	24	3	5	
1610688	8/24/2011	Municipal	6	8	18	24	3	5	
387704		Unknown	21	NE	19	024	04	5	
387705		Unknown	10	NE	19	024	04	5	
387706		Domestic & Stock	31	NE	19	024	04	5	
387707		Unknown	9	NE	19	024	04	5	
387708		Unknown	8	NE	19	024	04	5	
388874		Domestic	52	SE	19	024	03	5	
388875		Stock	61	NW	19	024	03	5	
388876		Domestic	30	NE	19	024	03	5	
402318	3/11/1995	Domestic	44	SE	19	024	03	5	
2066005	6/30/2010	Domestic	30	SE	19	24	4	5	
341435	6/25/1998	Domestic	34	NE	20	024	03	5	
349235	7/26/1988	Domestic	53	NE	20	024	03	5	
349236	7/25/1988	Domestic	52	NE	20	024	03	5	
349407	10/30/1985	Domestic	37	NE	20	024	03	5	
349908	7/2/1996	Domestic	37	NE	20	024	03	5	
362749	12/6/1991	Domestic	45	NE	20	024	03	5	
388890		Stock	30	SE	20	024	03	5	
388892		Unknown	37	NE	20	024	03	5	
388893		Domestic	40	NE	20	024	03	5	
388894	2/20/1987	Domestic	37	NE	20	024	03	5	
388895	8/11/1988	Domestic & Stock	23	NE	20	024	03	5	
388896		Unknown	19	00	20	024	03	5	
1021790	11/24/2008	Stock	27	SE	20	024	04	5	
1465050	6/16/2013	Domestic	55	8	20	24	3	5	
1465051	6/20/2013	Domestic	49	8	20	24	3	5	
349174	8/30/1989	Stock	59	NE	21	024	04	5	
349986	5/7/1997	Domestic	32	NE	21	024	03	5	
352722	9/27/1990	Domestic	20	15	21	024	03	5	
352723	9/27/1990	Domestic	20	15	21	024	03	5	
356544	2/5/1991	Domestic	30	NE	21	024	03	5	
356545	2/26/1991	Domestic	30	NE	21	024	03	5	
356546	3/1/1991	Domestic	30	NE	21	024	03	5	
356547	3/6/1991	Domestic	30	NE	21	024	03	5	
357783		Stock	27	NW	21	024	04	5	
358138	5/10/1991	Domestic	30	NE	21	024	03	5	
358491	6/4/1991	Domestic	20	09	21	024	03	5	
358492	6/5/1991	Domestic	20	09	21	024	03	5	
366137	8/14/1992	Domestic	30	NE	21	024	03	5	
373502	10/4/1993	Domestic	30	NE	21	024	03	5	
381942	8/16/1995	Domestic	20	NE	21	024	03	5	
386027	7/15/1994	Domestic	30	NE	21	024	03	5	
386031	7/25/1994	Domestic	34	NE	21	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
388897	11/26/1974	Domestic	29	SE	21	024	03	5	
388898		Domestic	24	SE	21	024	03	5	
388899		Domestic	26	SE	21	024	03	5	
388901	2/1/1978	Domestic	37	SE	21	024	03	5	
388902	1/4/1988	Domestic	30	SE	21	024	03	5	
388903	7/23/1988	Domestic	21	SE	21	024	03	5	
388905		Domestic	93	SW	21	024	03	5	
388906	6/13/1985	Domestic	75	SW	21	024	03	5	
388907		Domestic	26	NW	21	024	03	5	
388908		Domestic	24	NW	21	024	03	5	
388909		Domestic	24	NW	21	024	03	5	
388910		Domestic	24	NW	21	024	03	5	
388912		Domestic	46	NW	21	024	03	5	
388913	5/29/1987	Domestic	41	NW	21	024	03	5	
388914	5/24/1977	Domestic	25	9	21	24	3	5	
388915	7/28/1978	Domestic	20	NE	21	024	03	5	
388917	2/1/1986	Domestic	30	NE	21	024	03	5	
388918	3/1/1986	Domestic	30	NE	21	024	03	5	
388919	3/1/1986	Domestic	30	NE	21	024	03	5	
393383	7/7/1994	Domestic	30	NE	21	024	03	5	
393385	7/10/1994	Domestic	30	NE	21	024	03	5	
418134	6/25/1995	Domestic	29	NE	21	024	03	5	
418135	6/26/1995	Domestic	24	NE	21	024	03	5	
418136	6/28/1995	Domestic	24	NE	21	024	03	5	
418137	6/29/1995	Domestic	24	NE	21	024	03	5	
418138	6/28/1995	Domestic	24	NE	21	024	03	5	
418139	6/27/1995	Domestic	24	NE	21	024	03	5	
418140	6/26/1995	Domestic	24	NE	21	024	03	5	
467141	5/8/1997	Domestic	20	NE	21	024	03	5	
467142	10/10/1996	Domestic	37	NE	21	024	03	5	
467146	9/6/1996	Domestic	28	SE	21	024	03	5	
467147	8/23/1996	Domestic	43	SE	21	024	03	5	
467148	9/7/1996	Domestic	28	SE	21	024	03	5	
498383	6/13/2001	Domestic	28	SE	21	024	03	5	
498384	6/14/2001	Domestic	30	SE	21	024	03	5	
1021014	3/31/2003	Domestic	23	SW	21	024	03	5	
1021205	3/7/2006	Domestic	23	NE	21	024	03	5	
1022293	11/21/2012	Domestic	24	2	21	24	3	5	
1022469	6/6/2006	Domestic	41	4	21	24	3	5	
1555410	8/31/2006	Domestic	37	NE	21	024	03	5	
341641	9/26/2002	Stock	49	SW	22	024	04	5	
349217	8/30/1988	Domestic	34	NW	22	024	03	5	
349218	10/4/1988	Domestic	37	NW	22	024	03	5	
349219	10/4/1988	Domestic	27	NW	22	024	03	5	
349220	10/5/1988	Domestic	26	NW	22	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
349247	9/30/1988	Domestic	37	NW	22	024	03	5	
349248	8/29/1988	Domestic	37	NW	22	024	03	5	
349267	4/8/1988	Domestic & Stock	40	SE	22	024	04	5	
349277	3/31/1988	Domestic	35	NW	22	024	03	5	
349830	7/19/1995	Stock	67	NW	22	024	03	5	
350354	2/22/1990	Domestic	18	SW	22	024	03	5	
350355	2/20/1990	Domestic	24	SW	22	024	03	5	
350660	2/7/1990	Domestic	18	SW	22	024	03	5	
366404	10/2/1992	Domestic	25	NW	22	024	03	5	
366405	10/1/1992	Domestic	25	NW	22	024	03	5	
366406	10/2/1992	Domestic	24	NW	22	024	03	5	
386033	7/19/1994	Domestic	18	SW	22	024	03	5	
386037	8/23/1994	Domestic	18	NW	22	024	03	5	
386042	8/22/1994	Domestic	24	NW	22	024	03	5	
386046	8/22/1994	Domestic	20	NW	22	024	03	5	
387802		Stock	46	NW	22	024	04	5	
387805	1/12/1985	Domestic & Stock	35	NW	22	024	04	5	Yes
387808		Domestic	30	NE	22	024	04	5	Yes
388921		Domestic	23	SW	22	024	03	5	
388922	3/22/1989	Domestic	24	SW	22	024	03	5	
388923		Domestic	18	NW	22	024	03	5	
388924	4/21/1975	Domestic	24	NW	22	024	03	5	
388926	4/7/1988	Domestic	27	NW	22	024	03	5	
388927	4/11/1988	Domestic	32	NW	22	024	03	5	
388928	3/24/1989	Domestic	61	NW	22	024	03	5	
388929	4/6/1989	Domestic	23	NW	22	024	03	5	
388930	4/6/1989	Domestic	23	NW	22	024	03	5	
388934	4/18/1975	Domestic	24	11	22	024	03	5	
388935	4/17/1975	Domestic	24	12	22	024	03	5	
388937		Domestic	30	NW	22	024	03	5	
388939		Domestic	30	NW	22	024	03	5	
467143	5/14/1997	Domestic	21	NW	22	024	03	5	
467144	5/13/1997	Domestic	23	NW	22	024	03	5	
467145	5/12/1997	Domestic	23	NW	22	024	03	5	
469209	4/1/1998	Domestic	19	NW	22	024	03	5	
469210	3/31/1998	Domestic	19	NW	22	024	03	5	
499373	9/2/2001	Domestic	37	NW	22	024	03	5	
1022247	5/15/2012	Domestic	47	3	22	24	4	5	
1065384	10/17/2007	Domestic	24	04	22	024	04	5	
1140067	4/18/2002	Domestic	18	14	22	024	03	5	
1245005	7/19/2004	Domestic	43	SE	22	024	04	5	
1555573	7/24/2006	Domestic	24	NW	22	024	03	5	
1555796	4/18/2008	Domestic	27	SW	22	024	03	5	
1610568	9/28/2009	Domestic	37	13	22	24	3	5	
2090502	10/16/2008	Domestic	62	SE	22	024	04	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
2090503	10/21/2008	Domestic	27	SE	22	024	04	5	
387813		Stock	64	SE	23	024	04	5	Yes
387819		Unknown	37	NE	24	024	04	5	
387820		Stock	40	NE	24	024	04	5	
491787	2/22/1999	Domestic	43	NE	24	024	04	5	
492942	4/7/1999	Domestic	43	SE	24	024	04	5	
9546128	9/17/2014	Domestic	12	NE	24	24	4	5	
387822	7/3/1985	Domestic & Stock	40	SE	25	024	04	5	Yes
387823	6/24/1987	Domestic & Stock	41	SE	25	024	04	5	Yes
387825		Stock	30	SW	25	024	04	5	Yes
491432	3/11/1999	Domestic	128	NW	25	024	04	5	Yes
349308	9/22/1987	Stock	49	SW	26	024	04	5	Yes
341638	11/4/1985	Domestic	23	NW	27	024	03	5	
349272	6/1/1988	Stock	46	SW	27	024	04	5	Yes
364650	5/6/1992	Domestic & Stock	37	NE	27	024	04	5	Yes
389135		Industrial	85	SW	27	024	03	5	
389137		Unknown	104	SW	27	024	03	5	
389139	8/23/1978	Domestic	41	SW	27	024	03	5	
389142		Domestic	43	SW	27	024	03	5	
389149	10/5/1988	Domestic	35	SW	27	024	03	5	
389152		Domestic	37	NW	27	024	03	5	
389153		Unknown	27	NW	27	024	03	5	
492943	6/21/1999	Domestic	37	NW	27	024	04	5	Yes
1020664	11/4/2005	Domestic	27	NW	27	024	03	5	
341365	8/14/2000	Domestic	23	SW	28	024	03	5	
349442	9/4/1987	Domestic	26	SW	28	024	03	5	
349530	4/11/1985	Stock	34	NE	28	024	04	5	
349531	4/15/1985	Domestic	15	NE	28	024	04	5	
349567	4/17/1986	Domestic & Stock	46	SW	28	024	03	5	
349568	4/15/1986	Domestic & Stock	46	SW	28	024	03	5	
349569	4/28/1986	Domestic & Stock	46	SW	28	024	03	5	
349834	11/17/1995	Domestic	21	NE	28	024	03	5	
350661	2/28/1990	Domestic	55	SW	28	024	03	5	
350662	3/3/1990	Domestic	37	SW	28	024	03	5	
350663	3/4/1990	Domestic	43	SW	28	024	03	5	
351073	5/4/1990	Domestic	28	SW	28	024	03	5	
351623	5/1/1990	Domestic	24	SW	28	024	03	5	
352070	4/30/1990	Domestic	24	SW	28	024	03	5	
361021	11/21/1991	Stock	24	NE	28	024	03	5	
387836		Stock	18	SW	28	024	04	5	
387838	8/16/1984	Stock	34	NW	28	024	04	5	
387841		Stock	30	NE	28	024	04	5	
387842	4/11/1985	Stock	34	NE	28	024	04	5	
389184		Domestic	21	SE	28	024	03	5	
389185		Stock	18	SE	28	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
389186		Unknown	18	SE	28	024	03	5	
389192		Domestic	26	SW	28	024	03	5	
389194		Domestic	26	SW	28	024	03	5	
389199	5/1/1986	Domestic & Stock	24	SW	28	024	03	5	
389201	10/2/1989	Domestic & Stock	23	SW	28	024	03	5	
389202	10/2/1975	Irrigation	11	SW	28	024	03	5	
389211	9/30/1975	Domestic	12	SW	28	024	03	5	
389212	3/15/1977	Domestic	30	SW	28	024	03	5	
389213		Domestic	49	NW	28	024	03	5	
389217		Domestic & Stock	16	NE	28	024	03	5	
389218		Domestic	24	NE	28	024	03	5	
389219		Domestic	37	NE	28	024	03	5	
389222		Stock	37	00	28	024	03	5	
389224		Stock	0	00	28	024	03	5	
399936		Municipal	31	NE	28	024	03	5	
402460	3/15/1995	Domestic	18	SW	28	024	03	5	
458910	10/10/2001	Domestic	35	SW	28	024	03	5	
458911	10/11/2001	Domestic	41	SW	28	024	03	5	
466081	4/1/1996	Domestic	49	06	28	024	03	5	
466082	4/30/1996	Domestic	68	06	28	024	03	5	
1020672	6/25/2003	Domestic	40	SW	28	024	03	5	
1020673	2/5/2004	Domestic	66	SW	28	024	03	5	
394591	7/1/1977	Domestic	37	SE	29	024	03	5	
394595	5/30/1978	Domestic	18	SE	29	024	03	5	
394598	8/11/1988	Domestic	27	SE	29	024	03	5	
394604	10/8/1980	Stock	41	SW	29	024	03	5	
394610	8/11/1988	Stock	11	NE	29	024	03	5	
467149	6/3/1996	Domestic	18	08	29	024	03	5	
1555784	11/8/2007	Domestic	24	NE	29	024	03	5	
1600208	11/20/2009	Domestic	18	01	29	24	3	5	
416384	5/23/1980	Stock	53	SE	3	25	4	5	
416384		Domestic	49	SE	3	25	4	5	
394615	11/3/1979	Stock	76	SE	30	024	03	5	
394621		Domestic & Stock	79	08	30	024	03	5	
394627	10/1/1980	Domestic	200	SW	30	024	03	5	
394628	9/20/1975	Domestic & Stock	49	NW	30	024	03	5	
394635		Unknown	26	NW	30	024	03	5	
491786	2/19/1999	Domestic	43	SE	30	024	03	5	
394637		Stock	52	NE	31	024	03	5	
1305324	10/6/2008	Domestic	40	NE	31	24	3	5	
1305325	10/5/2008	Domestic	37	NE	31	24	3	5	
387855		Domestic	61	SE	32	024	04	5	
394638	9/6/1977	Stock	40	SE	32	024	03	5	
394641	1/10/1989	Stock	46	SE	32	024	03	5	
394646	8/27/1974	Stock	21	NE	32	024	03	5	

Table B-1 Groundwater Well Drilling Records in the RAA

GIC Well ID[1]	Drilling Date	Well Use	Total Depth (m)	LSD[2]	Section	Township	Range	Meridian	Field Verified[3]
351124	4/25/1990	Domestic	20	NE	33	024	03	5	
387861	7/8/1974	Domestic	46	NE	33	024	04	5	
394650	5/8/1974	Stock	41	NE	33	024	03	5	
394668	9/28/1978	Domestic	24	NE	33	024	03	5	
2095693	2/1/1973	Domestic	0	NE	33	24	4	5	
2095694	2/20/1975	Domestic & Stock	37	NE	33	24	4	5	
352158	9/14/1990	Domestic	26	SW	34	024	03	5	
387862	11/10/1987	Domestic	24	SE	34	024	04	5	
387863	8/15/1987	Domestic	35	SE	34	024	04	5	
387866		Domestic & Stock	23	NW	34	024	04	5	
387867	8/31/1983	Stock	35	NW	34	024	04	5	
466083	6/8/1996	Domestic	67	SW	34	024	03	5	
1020644	9/15/2004	Domestic	35	NW	34	024	04	5	
1021808	8/13/2008	Other	35	SE	34	024	04	5	
1475346	10/15/2003	Industrial	27	07	34	024	04	5	
387868		Stock	23	SE	35	024	04	5	
387869		Domestic	27	SE	35	024	04	5	
387870		Domestic	30	SE	35	024	04	5	
387871	10/17/1974	Domestic	55	SW	35	024	04	5	Yes
387872		Domestic	24	SW	35	024	04	5	
387873		Stock	27	SW	35	024	04	5	Yes
399673	9/29/1994	Domestic	81	03	35	024	04	5	
350054	2/3/1998	Domestic	88	NW	36	024	04	5	
387875	10/10/1980	Stock	13	SW	36	024	04	5	
496647	7/17/2000	Domestic	9	SE	36	024	04	5	
496648	7/13/2000	Domestic	24	SE	36	024	04	5	
1476960	4/5/2016	Domestic & Stock	30	9	4	25	4	5	
1600250	2/23/2012	Irrigation	29	2	4	25	3	5	
2066082	12/6/2014	Domestic	29	SE	6	25	3	5	
1065691	11/18/2008	Domestic	85	SE	7	24	4	5	
1065887	6/30/2009	Domestic	61	08	7	24	4	5	
1065894	6/17/2009	Domestic	134	SE	7	24	4	5	
2096453	1/1/1991	Domestic	6	9	9	24	3	5	

[1] Groundwater Information Centre Identification Number

[2] Legal Site Description

[3] Well Record was verified in the field during the domestic well testing program

Attachment C GROUNDWATER MONITORING LABORATORY ANALYTICAL RESULTS

Attachment C Groundwater Monitoring Laboratory Analytical Results
March 2018

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031849

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/03
Report #: R2273769
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684017
Received: 2016/09/26, 19:33

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2016/09/27	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	1	N/A	2016/10/01	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	1	2016/09/27	2016/09/28	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	1	2016/09/27	2016/09/28	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) (1)	1	N/A	2016/09/30	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	1	N/A	2016/09/27	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	1	2016/09/27	2016/09/28	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/09/29	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	1	2016/09/29	2016/09/29	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	1	2016/09/29	2016/09/29	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	1	N/A	2016/09/28	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	1	N/A	2016/09/28	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	1	N/A	2016/09/28	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/09/29	AB WI-00065	Auto Calc
Ammonia-N (Dissolved)	1	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	1	N/A	2016/09/28	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	1	N/A	2016/09/28	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2016/09/27	AB SOP-00023	SM 22 4110 B m
pH @25°C	1	N/A	2016/09/27	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	1	N/A	2016/09/28	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	1	2016/09/27	2016/09/29	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	1	N/A	2016/10/01	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	1	2016/09/30	2016/09/30	AB SOP-00008	EPA 351.1 R1978 m
Phosphorus -P (Total, Dissolved)	1	2016/09/29	2016/09/30	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031849

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/03
Report #: R2273769
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684017
Received: 2016/09/26, 19:33

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	MW16-15-34	RDL	QC Batch
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	8411843
Volatiles				
Benzene	mg/L	<0.00040	0.00040	8416232
Toluene	mg/L	<0.00040	0.00040	8416232
Ethylbenzene	mg/L	<0.00040	0.00040	8416232
m & p-Xylene	mg/L	<0.00080	0.00080	8416232
o-Xylene	mg/L	<0.00040	0.00040	8416232
Xylenes (Total)	mg/L	<0.00080	0.00080	8416232
F1 (C6-C10) - BTEX	mg/L	<0.10	0.10	8416232
F1 (C6-C10)	mg/L	<0.10	0.10	8416232
Surrogate Recovery (%)				
1,4-Difluorobenzene (sur.)	%	108	N/A	8416232
4-Bromofluorobenzene (sur.)	%	106	N/A	8416232
D4-1,2-Dichloroethane (sur.)	%	121	N/A	8416232
O-TERPHENYL (sur.)	%	94	N/A	8411843

RDL = Reportable Detection Limit
N/A = Not Applicable

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	MW16-15-34	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	11	N/A	8411319
Cation Sum	meq/L	10	N/A	8411319
Hardness (CaCO3)	mg/L	52	0.50	8411317
Ion Balance	N/A	0.95	0.010	8411318
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8411320
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8411321
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8411320
Calculated Total Dissolved Solids	mg/L	610	10	8411322
Misc. Inorganics				
Conductivity	uS/cm	1000	1.0	8412214
pH	pH	8.31	N/A	8412213
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8412208
Alkalinity (Total as CaCO3)	mg/L	350	0.50	8412208
Bicarbonate (HCO3)	mg/L	430	0.50	8412208
Carbonate (CO3)	mg/L	<0.50	0.50	8412208
Hydroxide (OH)	mg/L	<0.50	0.50	8412208
Dissolved Sulphate (SO4)	mg/L	170	1.0	8418346
Dissolved Chloride (Cl)	mg/L	3.4	1.0	8418338
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8412585
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8412585
Elements				
Dissolved Aluminum (Al)	mg/L	0.0040	0.0030	8413830
Dissolved Antimony (Sb)	mg/L	0.0013	0.00060	8413830
Dissolved Arsenic (As)	mg/L	0.0010	0.00020	8413830
Dissolved Barium (Ba)	mg/L	0.013	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8413830
Dissolved Boron (B)	mg/L	0.040	0.020	8414668
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8413830

RDL = Reportable Detection Limit
N/A = Not Applicable

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	MW16-15-34	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	14	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8413830
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8413830
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8413830
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8413830
Dissolved Lithium (Li)	mg/L	0.074	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	4.2	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.028	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.018	0.00020	8413830
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8413830
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8414668
Dissolved Potassium (K)	mg/L	2.4	0.30	8414668
Dissolved Selenium (Se)	mg/L	0.00065	0.00020	8413830
Dissolved Silicon (Si)	mg/L	2.6	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8413830
Dissolved Sodium (Na)	mg/L	210	0.50	8414668
Dissolved Strontium (Sr)	mg/L	0.25	0.020	8414668
Dissolved Sulphur (S)	mg/L	51	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8413830
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8413830
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8413830
Dissolved Uranium (U)	mg/L	0.00024	0.00010	8413830
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8413830
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8413830
RDL = Reportable Detection Limit				

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP4727	PP4727		
Sampling Date		2016/09/26 14:38	2016/09/26 14:38		
COC Number		M031849	M031849		
	UNITS	MW16-15-34	MW16-15-34 Lab-Dup	RDL	QC Batch
Misc. Inorganics					
Dissolved Organic Carbon (C)	mg/L	1.7	1.7	0.50	8417244
Microbiological Param.					
E.Coli DST	mpn/100mL	<1.0	N/A	1.0	8412377
Fecal Coliforms	MPN/100mL	<1.0	N/A	1.0	8412376
Heterotrophic Plate Count	CFU/mL	39	45	1.0	8412470
Total Coliforms DST	mpn/100mL	<1.0	N/A	1.0	8412377
Nutrients					
Dissolved Ammonia (N)	mg/L	0.99 (1)	0.95 (1)	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	0.90 (1)	N/A	0.050	8416562
Orthophosphate (P)	mg/L	0.0038	N/A	0.0030	8414603
Dissolved Phosphorus (P)	mg/L	0.0057	0.0057	0.0030	8415469

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Ammonia greater than TKN. Results are within acceptable limits of precision.

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STANTEC CONSULTING LTD
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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	**MW16-15-34**	**RDL**	**QC Batch**
Low Level Elements				
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	8415298
Total Mercury (Hg)	ug/L	<0.10 (1)	0.10	8415274

RDL = Reportable Detection Limit

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	9.7°C

Results relate only to the items tested.

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8411843	LSH	Matrix Spike	O-TERPHENYL (sur.)	2016/09/27		91	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/27		88	%	50 - 130
8411843	LSH	Spiked Blank	O-TERPHENYL (sur.)	2016/09/27		95	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/27		88	%	70 - 130
8411843	LSH	Method Blank	O-TERPHENYL (sur.)	2016/09/27		93	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/27	<0.10		mg/L	
8411843	LSH	RPD	F2 (C10-C16 Hydrocarbons)	2016/09/28	NC		%	40
8412208	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/27		99	%	80 - 120
8412208	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/27	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/27	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/27	<0.50		mg/L	
			Carbonate (CO3)	2016/09/27	<0.50		mg/L	
			Hydroxide (OH)	2016/09/27	<0.50		mg/L	
8412208	SSO	RPD	Alkalinity (PP as CaCO3)	2016/09/27	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/27	6.1		%	20
			Bicarbonate (HCO3)	2016/09/27	6.1		%	20
			Carbonate (CO3)	2016/09/27	NC		%	20
			Hydroxide (OH)	2016/09/27	NC		%	20
8412213	SSO	Spiked Blank	pH	2016/09/27		100	%	97 - 103
8412213	SSO	RPD	pH	2016/09/27	0.17		%	N/A
8412214	SSO	Spiked Blank	Conductivity	2016/09/27		100	%	90 - 110
8412214	SSO	Method Blank	Conductivity	2016/09/27	<1.0		uS/cm	
8412214	SSO	RPD	Conductivity	2016/09/27	0.12		%	20
8412376	AP1	Method Blank	Fecal Coliforms	2016/09/28	<1.0		MPN/10	
8412376	AP1	RPD	Fecal Coliforms	2016/09/28	NC		%	N/A
8412377	AP1	Method Blank	E.Coli DST	2016/09/28	<1.0		mpn/100	
			Total Coliforms DST	2016/09/28	<1.0 (1)		mpn/100	
8412377	AP1	RPD	Total Coliforms DST	2016/09/28	NC		%	N/A
8412470	AP1	Method Blank	Heterotrophic Plate Count	2016/09/29	<1.0		CFU/mL	
8412470	AP1	RPD [PP4727-08]	Heterotrophic Plate Count	2016/09/29	14		%	N/A
8412585	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/09/27		102	%	80 - 120
			Dissolved Nitrate (N)	2016/09/27		103	%	80 - 120
8412585	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/27		100	%	80 - 120
			Dissolved Nitrate (N)	2016/09/27		101	%	80 - 120
8412585	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/27	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/27	<0.010		mg/L	
8412585	JLD	RPD	Dissolved Nitrite (N)	2016/09/27	NC		%	20
			Dissolved Nitrate (N)	2016/09/27	NC		%	20
8413830	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/09/28		NC	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/28		94	%	80 - 120
			Dissolved Arsenic (As)	2016/09/28		102	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/28		90	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/28		102	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/28		103	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/28		101	%	80 - 120
			Dissolved Copper (Cu)	2016/09/28		99	%	80 - 120
			Dissolved Lead (Pb)	2016/09/28		103	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/28		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/28		95	%	80 - 120
			Dissolved Selenium (Se)	2016/09/28		100	%	80 - 120
			Dissolved Silver (Ag)	2016/09/28		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/28		105	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/09/28		99	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/28		97	%	80 - 120
			Dissolved Uranium (U)	2016/09/28		101	%	80 - 120
			Dissolved Vanadium (V)	2016/09/28		102	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/28		105	%	80 - 120
8413830	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/28		101	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/28		93	%	80 - 120
			Dissolved Arsenic (As)	2016/09/28		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/28		90	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/28		99	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/28		99	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/28		97	%	80 - 120
			Dissolved Copper (Cu)	2016/09/28		98	%	80 - 120
			Dissolved Lead (Pb)	2016/09/28		100	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/28		100	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/28		93	%	80 - 120
			Dissolved Selenium (Se)	2016/09/28		100	%	80 - 120
			Dissolved Silver (Ag)	2016/09/28		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/28		102	%	80 - 120
			Dissolved Tin (Sn)	2016/09/28		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/28		93	%	80 - 120
			Dissolved Uranium (U)	2016/09/28		99	%	80 - 120
			Dissolved Vanadium (V)	2016/09/28		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/28		100	%	80 - 120
8413830	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/28	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/28	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/28	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/28	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/28	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/28	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/28	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/28	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/28	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/28	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/28	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/28	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/28	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/28	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/28	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/28	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/28	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/28	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/28	<0.0030		mg/L	
8413830	PC5	RPD	Dissolved Aluminum (Al)	2016/09/28	1.1		%	20
			Dissolved Antimony (Sb)	2016/09/28	NC		%	20
			Dissolved Arsenic (As)	2016/09/28	NC		%	20
			Dissolved Beryllium (Be)	2016/09/28	NC		%	20
			Dissolved Chromium (Cr)	2016/09/28	NC		%	20
			Dissolved Cobalt (Co)	2016/09/28	NC		%	20
			Dissolved Copper (Cu)	2016/09/28	NC		%	20
			Dissolved Lead (Pb)	2016/09/28	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/28	NC		%	20

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STANTEC CONSULTING LTD
Client Project #: 110773396
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2016/09/28	NC		%	20
			Dissolved Selenium (Se)	2016/09/28	NC		%	20
			Dissolved Silver (Ag)	2016/09/28	NC		%	20
			Dissolved Thallium (Tl)	2016/09/28	NC		%	20
			Dissolved Tin (Sn)	2016/09/28	NC		%	20
			Dissolved Titanium (Ti)	2016/09/28	NC		%	20
			Dissolved Uranium (U)	2016/09/28	NC		%	20
			Dissolved Vanadium (V)	2016/09/28	NC		%	20
			Dissolved Zinc (Zn)	2016/09/28	NC		%	20
8414603	MB5	Matrix Spike	Orthophosphate (P)	2016/09/28		95	%	80 - 120
8414603	MB5	Spiked Blank	Orthophosphate (P)	2016/09/28		100	%	80 - 120
8414603	MB5	Method Blank	Orthophosphate (P)	2016/09/28	<0.0030		mg/L	
8414603	MB5	RPD	Orthophosphate (P)	2016/09/28	NC		%	20
8414668	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/09/28		90	%	80 - 120
			Dissolved Boron (B)	2016/09/28		87	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		90	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		88	%	80 - 120
			Dissolved Lithium (Li)	2016/09/28		91	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		96	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		89	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		99	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		91	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		87	%	80 - 120
8414668	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/09/28		92	%	80 - 120
			Dissolved Boron (B)	2016/09/28		88	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		97	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		91	%	80 - 120
			Dissolved Lithium (Li)	2016/09/28		93	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		100	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		93	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		98	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		94	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		95	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		89	%	80 - 120
8414668	JHC	Method Blank	Dissolved Barium (Ba)	2016/09/28	<0.010		mg/L	
			Dissolved Boron (B)	2016/09/28	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/09/28	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/28	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/09/28	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/09/28	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/28	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/09/28	<0.10		mg/L	
			Dissolved Potassium (K)	2016/09/28	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/09/28	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/09/28	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/09/28	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/09/28	<0.20		mg/L	
8414668	JHC	RPD	Dissolved Barium (Ba)	2016/09/28	0.0078		%	20
			Dissolved Boron (B)	2016/09/28	NC		%	20

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Calcium (Ca)	2016/09/28	0.0054		%	20
			Dissolved Iron (Fe)	2016/09/28	NC		%	20
			Dissolved Lithium (Li)	2016/09/28	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/28	0.051		%	20
			Dissolved Manganese (Mn)	2016/09/28	0.054		%	20
			Dissolved Phosphorus (P)	2016/09/28	NC		%	20
			Dissolved Potassium (K)	2016/09/28	1.6		%	20
			Dissolved Silicon (Si)	2016/09/28	0.29		%	20
			Dissolved Sodium (Na)	2016/09/28	0.082		%	20
			Dissolved Strontium (Sr)	2016/09/28	0.0033		%	20
			Dissolved Sulphur (S)	2016/09/28	0.015		%	20
8415274	RK3	Matrix Spike	Total Mercury (Hg)	2016/09/29		111	%	80 - 120
8415274	RK3	Spiked Blank	Total Mercury (Hg)	2016/09/29		95	%	80 - 120
8415274	RK3	Method Blank	Total Mercury (Hg)	2016/09/29	<0.0020		ug/L	
8415274	RK3	RPD	Total Mercury (Hg)	2016/09/29	NC		%	20
8415298	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/09/29		116	%	80 - 120
8415298	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/29		96	%	80 - 120
8415298	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/29	<0.0020		ug/L	
8415298	RK3	RPD	Dissolved Mercury (Hg)	2016/09/29	NC		%	20
8415469	MB5	Matrix Spike [PP4727-05]	Dissolved Phosphorus (P)	2016/09/30		91	%	80 - 120
8415469	MB5	QC Standard	Dissolved Phosphorus (P)	2016/09/30		96	%	80 - 120
8415469	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/09/30		97	%	80 - 120
8415469	MB5	Method Blank	Dissolved Phosphorus (P)	2016/09/30	<0.0030		mg/L	
8415469	MB5	RPD [PP4727-05]	Dissolved Phosphorus (P)	2016/09/30	NC		%	20
8416232	GP4	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/01		100	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/01		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/01		119	%	70 - 130
			Benzene	2016/10/01		110	%	70 - 130
			Toluene	2016/10/01		106	%	70 - 130
			Ethylbenzene	2016/10/01		113	%	70 - 130
			m & p-Xylene	2016/10/01		112	%	70 - 130
			o-Xylene	2016/10/01		116	%	70 - 130
			F1 (C6-C10)	2016/10/01		87	%	70 - 130
8416232	GP4	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/01		101	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/01		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/01		116	%	70 - 130
			Benzene	2016/10/01		111	%	70 - 130
			Toluene	2016/10/01		108	%	70 - 130
			Ethylbenzene	2016/10/01		116	%	70 - 130
			m & p-Xylene	2016/10/01		115	%	70 - 130
			o-Xylene	2016/10/01		119	%	70 - 130
			F1 (C6-C10)	2016/10/01		102	%	70 - 130
8416232	GP4	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/01		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/01		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/01		118	%	70 - 130
			Benzene	2016/10/01	<0.00040		mg/L	
			Toluene	2016/10/01	<0.00040		mg/L	
			Ethylbenzene	2016/10/01	<0.00040		mg/L	
			m & p-Xylene	2016/10/01	<0.00080		mg/L	
			o-Xylene	2016/10/01	<0.00040		mg/L	
			Xylenes (Total)	2016/10/01	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/01	<0.10		mg/L	

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/01	<0.10		mg/L	
8416232	GP4	RPD	Benzene	2016/10/01	NC		%	40
			Toluene	2016/10/01	NC		%	40
			Ethylbenzene	2016/10/01	NC		%	40
			m & p-Xylene	2016/10/01	NC		%	40
			o-Xylene	2016/10/01	NC		%	40
			Xylenes (Total)	2016/10/01	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/01	NC		%	40
			F1 (C6-C10)	2016/10/01	NC		%	40
8416562	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/09/30		88	%	80 - 120
8416562	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/09/30		90	%	80 - 120
8416562	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/09/30		87	%	80 - 120
8416562	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/09/30	<0.050		mg/L	
8416562	MB5	RPD	Total Kjeldahl Nitrogen	2016/09/30	NC		%	20
8417244	MUK	Matrix Spike [PP4727-05]	Dissolved Organic Carbon (C)	2016/09/30		103	%	80 - 120
8417244	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/09/30		98	%	80 - 120
8417244	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/09/30	<0.50		mg/L	
8417244	MUK	RPD [PP4727-05]	Dissolved Organic Carbon (C)	2016/09/30	NC		%	20
8417670	MB5	Matrix Spike [PP4727-05]	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD [PP4727-05]	Dissolved Ammonia (N)	2016/09/30	3.2 (2)		%	20
8418338	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/01		108	%	80 - 120
8418338	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/01		107	%	80 - 120
8418338	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/01	1.2, RDL=1.0		mg/L	
8418338	ZI	RPD	Dissolved Chloride (Cl)	2016/10/01	1.6		%	20
8418346	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/01		119	%	80 - 120
8418346	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/01		101	%	80 - 120
8418346	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/01	<1.0		mg/L	
8418346	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/01	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

(2) Ammonia greater than TKN. Results are within acceptable limits of precision.

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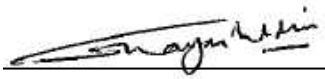
Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

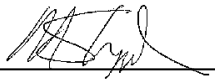
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Lisa Thum, C.E.T., QP, Manager, Inorganics



Michael Sheppard, B.Sc., P. Biol., QP, Senior Scientific Specialist, Organics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1137

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Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD M 031849 Page 1 of 1

Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd.	Company:	Quotation #:	☑ 5 - 7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112st, Edmonton AB, [redacted] T5K 2L6	Address:	Project #: 110773396	Rush TAT (Surcharges will be applied): ☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	Date Required:
Email: Dylan.King@stantec.com	Email:	Site #:	Rush Confirmation #:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D.Nisbet	

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		↘	Temp	10	9	10
Seal Intact		↘				
Cooling Media	↘					
	YES	NO	Cooler ID			
Seal Present			Temp			
Seal Intact						
Cooling Media						
	YES	NO	Cooler ID			
Seal Present			Temp			
Seal Intact						
Cooling Media						

Depot Reception

Analysis Requested

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	Phosphate	Ammonia (PISS)	TKN	DOC	Total Coliforms	E.Coli	Fecal coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-15-34		2016/09/26	14:38	W	13/14		✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

- ☑ AT1/CCME
- ☑ Drinking Water
- ☐ Saskatchewan
- ☐ D50 (Drilling Waste)
- ☐ Other:

Special Instructions

Submitted same day as sampled
Filtered and preserved as indicated on bottles
Hold total metals

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/26	19:33	[signature] JASON BIL	20160926	19:33

26-Sep-16 19:33
Wendy Sears
B684017
NB6 INS-0001

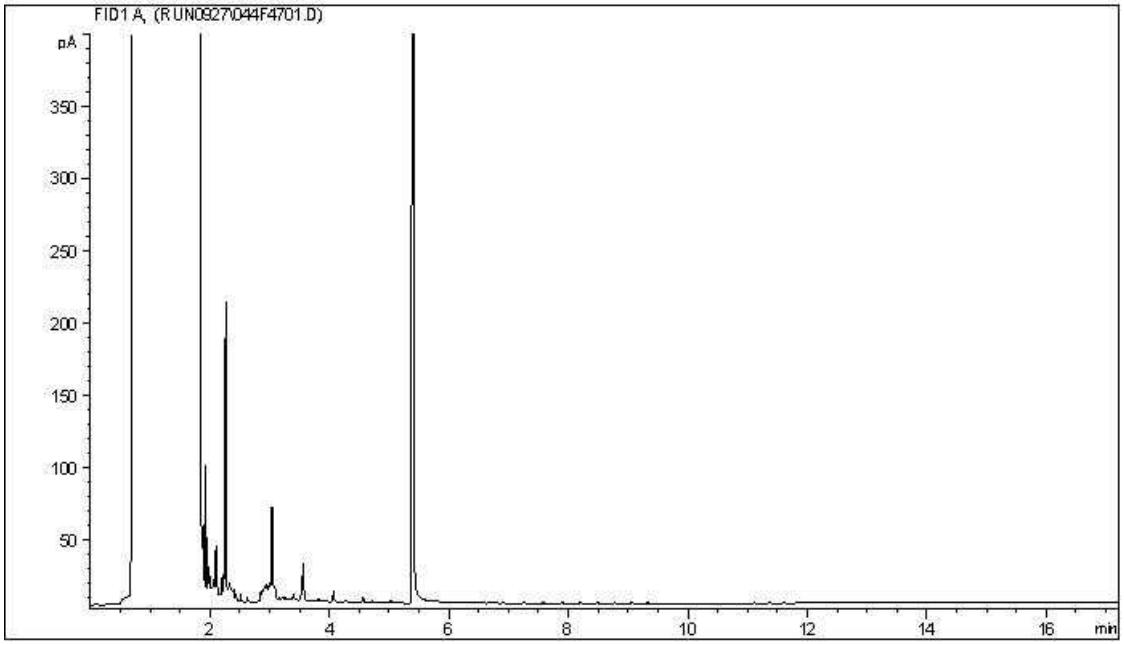
AB FCD-00331/6

Maxxam Job #: B684017
Report Date: 2016/10/03
Maxxam Sample: PP4727

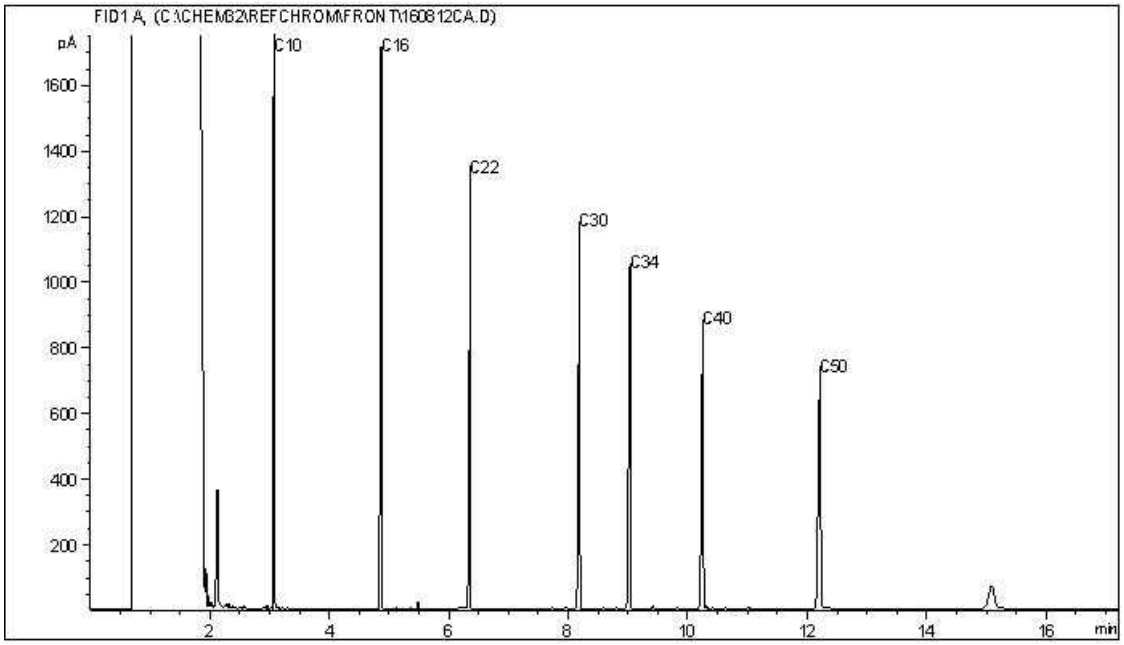
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-15-34

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

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Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031856

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/06
Report #: R2276976
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684487
Received: 2016/09/27, 18:56

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	6	N/A	2016/09/28	AB SOP-00005	SM 22 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2016/10/06	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	2	N/A	2016/10/02	AB SOP-00039	CCME CWS/EPA 8260c m
BTEX/F1 in Water by HS GC/MS/FID	5	N/A	2016/10/03	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry	6	N/A	2016/10/02	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	7	2016/09/28	2016/09/29	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	7	2016/09/28	2016/09/29	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/09/30	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	6	N/A	2016/09/30	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	7	N/A	2016/09/28	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	7	2016/09/29	2016/09/30	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	6	N/A	2016/09/29	AB WI-00065	Auto Calc
Hardness	1	N/A	2016/09/30	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	6	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	7	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	6	N/A	2016/09/28	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/06	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	6	N/A	2016/09/29	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/09/29	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	7	N/A	2016/09/29	AB WI-00065	Auto Calc
Sum of cations, anions	6	N/A	2016/09/29	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/09/30	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	6	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	7	N/A	2016/09/30	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	7	N/A	2016/09/30	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	7	N/A	2016/09/28	AB SOP-00023	SM 22 4110 B m

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Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031856

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/06
Report #: R2276976
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684487
Received: 2016/09/27, 18:56

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
pH @25°C	7	N/A	2016/09/28	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	7	N/A	2016/09/30	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry	6	N/A	2016/10/02	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	7	2016/09/28	2016/09/30	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	1	N/A	2016/10/01	AB WI-00065	Auto Calc
Total Dissolved Solids (Calculated)	6	N/A	2016/10/02	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	6	2016/09/30	2016/10/01	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	1	2016/10/02	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/09/29	2016/09/29	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	6	2016/09/30	2016/10/01	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PP7330	PP7330	PP7331	PP7332	PP7333	PP7334		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17	2016/09/27 10:07	2016/09/27 09:37	2016/09/27 17:50	2016/09/27 13:10		
COC Number		M031856	M031856	M031856	M031856	M031856	M031856		
	UNITS	MW16-14-33	MW16-14-33 Lab-Dup	MW16-6-11	MW16-6-20	MW16-7-5	MW16-19-8	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	<0.10	0.10	8414729
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
Toluene	mg/L	<0.00040	0.00048	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8417842
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8417842
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8417842
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8417842
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	109	109	107	109	110	109	N/A	8417842
4-Bromofluorobenzene (sur.)	%	105	106	106	105	105	106	N/A	8417842
D4-1,2-Dichloroethane (sur.)	%	120	123	123	120	121	120	N/A	8417842
O-TERPHENYL (sur.)	%	86	N/A	84	86	84	86	N/A	8414729

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PP7335	PP7336		
Sampling Date		2016/09/27 13:42	2016/09/27 15:36		
COC Number		M031856	M031856		
	UNITS	MW16-19-19	MW16-20-21	RDL	QC Batch
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8414729
Volatiles					
Benzene	mg/L	<0.00040	0.0010	0.00040	8417842
Toluene	mg/L	<0.00040	0.00050	0.00040	8417842
Ethylbenzene	mg/L	<0.00040	<0.00040	0.00040	8417842
m & p-Xylene	mg/L	<0.00080	<0.00080	0.00080	8417842
o-Xylene	mg/L	<0.00040	<0.00040	0.00040	8417842
Xylenes (Total)	mg/L	<0.00080	<0.00080	0.00080	8417842
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	8417842
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	8417842
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	110	108	N/A	8417842
4-Bromofluorobenzene (sur.)	%	106	106	N/A	8417842
D4-1,2-Dichloroethane (sur.)	%	119	121	N/A	8417842
O-TERPHENYL (sur.)	%	84	82	N/A	8414729

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Maxxam Job #: B684487
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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7331		PP7332	PP7332		
Sampling Date		2016/09/27 10:07		2016/09/27 09:37	2016/09/27 09:37		
COC Number		M031856		M031856	M031856		
	UNITS	MW16-6-11	RDL	MW16-6-20	MW16-6-20 Lab-Dup	RDL	QC Batch
Calculated Parameters							
Anion Sum	meq/L	43	N/A	21	N/A	N/A	8413041
Cation Sum	meq/L	41	N/A	21	N/A	N/A	8413041
Hardness (CaCO3)	mg/L	1300	0.50	340	N/A	0.50	8413039
Ion Balance	N/A	0.95	0.010	0.98	N/A	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	0.086	N/A	0.044	8413042
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	<0.020	N/A	0.020	8413043
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	<0.033	N/A	0.033	8413042
Calculated Total Dissolved Solids	mg/L	2700	10	1400	N/A	10	8413044
Misc. Inorganics							
Conductivity	uS/cm	3300	1.0	2000	2000	1.0	8414429
pH	pH	7.53	N/A	7.99	N/A	N/A	8414428
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	8414424
Alkalinity (Total as CaCO3)	mg/L	330	0.50	260	270	0.50	8414424
Bicarbonate (HCO3)	mg/L	410	0.50	320	330	0.50	8414424
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	8414424
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	8414424
Dissolved Sulphate (SO4)	mg/L	1800 (1)	20	770 (1)	N/A	5.0	8419026
Dissolved Chloride (Cl)	mg/L	4.3	1.0	4.0	N/A	1.0	8419025
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	N/A	0.010	8414214
Dissolved Nitrate (N)	mg/L	<0.010	0.010	0.020	N/A	0.010	8414214
Elements							
Dissolved Aluminum (Al)	mg/L	0.0041	0.0030	0.0067	N/A	0.0030	8415439
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	<0.00060	N/A	0.00060	8415439
Dissolved Arsenic (As)	mg/L	0.00050	0.00020	0.00043	N/A	0.00020	8415439
Dissolved Barium (Ba)	mg/L	0.021	0.010	0.031	N/A	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Boron (B)	mg/L	0.13	0.020	0.093	N/A	0.020	8414668

RDL = Reportable Detection Limit
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(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7331		PP7332	PP7332		
Sampling Date		2016/09/27 10:07		2016/09/27 09:37	2016/09/27 09:37		
COC Number		M031856		M031856	M031856		
	UNITS	MW16-6-11	RDL	MW16-6-20	MW16-6-20 Lab-Dup	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.000058	0.000020	<0.000020	N/A	0.000020	8415439
Dissolved Calcium (Ca)	mg/L	310	0.30	76	N/A	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Cobalt (Co)	mg/L	0.0041	0.00030	0.00056	N/A	0.00030	8415439
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	0.00056	N/A	0.00020	8415439
Dissolved Iron (Fe)	mg/L	0.11	0.060	<0.060	N/A	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	<0.00020	N/A	0.00020	8415439
Dissolved Lithium (Li)	mg/L	0.049	0.020	0.044	N/A	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	140	0.20	36	N/A	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.85	0.0040	0.16	N/A	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.0014	0.00020	0.0060	N/A	0.00020	8415439
Dissolved Nickel (Ni)	mg/L	0.0064	0.00050	<0.00050	N/A	0.00050	8415439
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	<0.10	N/A	0.10	8414668
Dissolved Potassium (K)	mg/L	8.5	0.30	4.9	N/A	0.30	8414668
Dissolved Selenium (Se)	mg/L	0.00044	0.00020	<0.00020	N/A	0.00020	8415439
Dissolved Silicon (Si)	mg/L	5.0	0.10	3.4	N/A	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	<0.00010	N/A	0.00010	8415439
Dissolved Sodium (Na)	mg/L	330	0.50	320	N/A	0.50	8414668
Dissolved Strontium (Sr)	mg/L	2.4	0.020	0.78	N/A	0.020	8414668
Dissolved Sulphur (S)	mg/L	580 (1)	2.0	250	N/A	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	<0.00020	N/A	0.00020	8415439
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Uranium (U)	mg/L	0.0085	0.00010	0.0021	N/A	0.00010	8415439
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	<0.0030	N/A	0.0030	8415439

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7333	PP7333			PP7334		
Sampling Date		2016/09/27 17:50	2016/09/27 17:50			2016/09/27 13:10		
COC Number		M031856	M031856			M031856		
	UNITS	MW16-7-5	MW16-7-5 Lab-Dup	RDL	QC Batch	MW16-19-8	RDL	QC Batch
Calculated Parameters								
Anion Sum	meq/L	55	N/A	N/A	8413041	32	N/A	8413041
Cation Sum	meq/L	49	N/A	N/A	8413041	31	N/A	8413041
Hardness (CaCO3)	mg/L	1600	N/A	0.50	8413039	980	0.50	8413039
Ion Balance	N/A	0.90	N/A	0.010	8413040	0.96	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	<0.044	N/A	0.044	8413042	1.8	0.044	8413362
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8413043	0.42	0.020	8413363
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8413042	<0.033	0.033	8413362
Calculated Total Dissolved Solids	mg/L	3400	N/A	10	8413044	2000	10	8413044
Misc. Inorganics								
Conductivity	uS/cm	3900	N/A	1.0	8414429	2500	1.0	8414429
pH	pH	7.57	N/A	N/A	8414428	7.56	N/A	8414428
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8414424	<0.50	0.50	8414424
Alkalinity (Total as CaCO3)	mg/L	380	N/A	0.50	8414424	420	0.50	8414424
Bicarbonate (HCO3)	mg/L	470	N/A	0.50	8414424	520	0.50	8414424
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8414424	<0.50	0.50	8414424
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8414424	<0.50	0.50	8414424
Dissolved Sulphate (SO4)	mg/L	2200 (1)	N/A	20	8419026	1100 (1)	10	8419026
Dissolved Chloride (Cl)	mg/L	14	N/A	1.0	8419025	1.9	1.0	8419025
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	0.010	8414403	<0.010	0.010	8414403
Dissolved Nitrate (N)	mg/L	<0.010	<0.010	0.010	8414403	0.42	0.010	8414403
Elements								
Dissolved Aluminum (Al)	mg/L	0.0048	N/A	0.0030	8415439	0.0039	0.0030	8415439
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	0.00060	8415439	<0.00060	0.00060	8415439
Dissolved Arsenic (As)	mg/L	0.0010	N/A	0.00020	8415439	0.00030	0.00020	8415439
Dissolved Barium (Ba)	mg/L	0.032	N/A	0.010	8414668	0.013	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Boron (B)	mg/L	0.12	N/A	0.020	8414668	0.092	0.020	8414668

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
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(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7333	PP7333			PP7334		
Sampling Date		2016/09/27 17:50	2016/09/27 17:50			2016/09/27 13:10		
COC Number		M031856	M031856			M031856		
	UNITS	MW16-7-5	MW16-7-5 Lab-Dup	RDL	QC Batch	MW16-19-8	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.00013	N/A	0.000020	8415439	0.000057	0.000020	8415439
Dissolved Calcium (Ca)	mg/L	250	N/A	0.30	8414668	230	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Cobalt (Co)	mg/L	0.0051	N/A	0.00030	8415439	<0.00030	0.00030	8415439
Dissolved Copper (Cu)	mg/L	0.00097	N/A	0.00020	8415439	0.00059	0.00020	8415439
Dissolved Iron (Fe)	mg/L	<0.060	N/A	0.060	8414668	<0.060	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Lithium (Li)	mg/L	0.077	N/A	0.020	8414668	0.029	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	230	N/A	0.20	8414668	99	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.81	N/A	0.0040	8414668	0.071	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.0026	N/A	0.00020	8415439	0.00060	0.00020	8415439
Dissolved Nickel (Ni)	mg/L	0.011	N/A	0.00050	8415439	<0.00050	0.00050	8415439
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8414668	<0.10	0.10	8414668
Dissolved Potassium (K)	mg/L	5.9	N/A	0.30	8414668	5.9	0.30	8414668
Dissolved Selenium (Se)	mg/L	0.00046	N/A	0.00020	8415439	0.056	0.00020	8415439
Dissolved Silicon (Si)	mg/L	5.6	N/A	0.10	8414668	3.6	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8415439	<0.00010	0.00010	8415439
Dissolved Sodium (Na)	mg/L	400	N/A	0.50	8414668	260	0.50	8414668
Dissolved Strontium (Sr)	mg/L	2.4	N/A	0.020	8414668	1.4	0.020	8414668
Dissolved Sulphur (S)	mg/L	700 (1)	N/A	2.0	8414668	370	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Uranium (U)	mg/L	0.020	N/A	0.00010	8415439	0.013	0.00010	8415439
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	0.0030	8415439	<0.0030	0.0030	8415439

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7335			PP7336		
Sampling Date		2016/09/27 13:42			2016/09/27 15:36		
COC Number		M031856			M031856		
	UNITS	MW16-19-19	RDL	QC Batch	MW16-20-21	RDL	QC Batch
Calculated Parameters							
Anion Sum	meq/L	36	N/A	8413041	25	N/A	8413041
Cation Sum	meq/L	34	N/A	8413041	24	N/A	8413041
Hardness (CaCO3)	mg/L	600	0.50	8413039	740	0.50	8413039
Ion Balance	N/A	0.95	0.010	8413040	0.97	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8413362	0.085	0.044	8413362
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8413363	<0.020	0.020	8413363
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8413362	<0.033	0.033	8413362
Calculated Total Dissolved Solids	mg/L	2200	10	8413044	1500	10	8413044
Misc. Inorganics							
Conductivity	uS/cm	3000	1.0	8414429	2100	1.0	8414429
pH	pH	7.54	N/A	8414428	7.59	N/A	8414428
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8414424	<0.50	0.50	8414424
Alkalinity (Total as CaCO3)	mg/L	520	0.50	8414424	450	0.50	8414424
Bicarbonate (HCO3)	mg/L	640	0.50	8414424	540	0.50	8414424
Carbonate (CO3)	mg/L	<0.50	0.50	8414424	<0.50	0.50	8414424
Hydroxide (OH)	mg/L	<0.50	0.50	8414424	<0.50	0.50	8414424
Dissolved Sulphate (SO4)	mg/L	1200 (1)	10	8418346	760 (1)	5.0	8419026
Dissolved Chloride (Cl)	mg/L	1.7	1.0	8418338	3.3	1.0	8419025
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8414214	<0.010	0.010	8414403
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8414214	0.019	0.010	8414403
Elements							
Dissolved Aluminum (Al)	mg/L	0.0033	0.0030	8415439	0.0040	0.0030	8415439
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8415439	<0.00060	0.00060	8415439
Dissolved Arsenic (As)	mg/L	0.00033	0.00020	8415439	0.00043	0.00020	8415439
Dissolved Barium (Ba)	mg/L	<0.010	0.010	8414668	0.018	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Boron (B)	mg/L	0.13	0.020	8414668	0.076	0.020	8414668
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8415439	<0.000020	0.000020	8415439

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7335			PP7336		
Sampling Date		2016/09/27 13:42			2016/09/27 15:36		
COC Number		M031856			M031856		
	UNITS	MW16-19-19	RDL	QC Batch	MW16-20-21	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	140	0.30	8414668	160	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8415439	0.00085	0.00030	8415439
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Iron (Fe)	mg/L	2.6	0.060	8414668	0.69	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Lithium (Li)	mg/L	0.056	0.020	8414668	0.053	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	62	0.20	8414668	82	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.37	0.0040	8414668	0.34	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.0012	0.00020	8415439	0.0052	0.00020	8415439
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8415439	<0.00050	0.00050	8415439
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8414668	<0.10	0.10	8414668
Dissolved Potassium (K)	mg/L	5.9	0.30	8414668	8.9	0.30	8414668
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8415439	0.00090	0.00020	8415439
Dissolved Silicon (Si)	mg/L	3.4	0.10	8414668	4.0	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8415439	<0.00010	0.00010	8415439
Dissolved Sodium (Na)	mg/L	490	0.50	8414668	210	0.50	8414668
Dissolved Strontium (Sr)	mg/L	2.1	0.020	8414668	2.0	0.020	8414668
Dissolved Sulphur (S)	mg/L	370	0.20	8414668	240	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Uranium (U)	mg/L	0.00092	0.00010	8415439	0.0032	0.00010	8415439
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8415439	<0.0030	0.0030	8415439
RDL = Reportable Detection Limit							

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Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7330	PP7330		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17		
COC Number		M031856	M031856		
	UNITS	MW16-14-33	MW16-14-33 Lab-Dup	RDL	QC Batch
Calculated Parameters					
Anion Sum	meq/L	45	N/A	N/A	8413041
Cation Sum	meq/L	160	N/A	N/A	8413041
Hardness (CaCO3)	mg/L	6700	N/A	0.50	8413039
Ion Balance	N/A	3.4	N/A	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	0.072	N/A	0.044	8413042
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8413043
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8413042
Calculated Total Dissolved Solids	mg/L	4700	N/A	10	8413044
Misc. Inorganics					
Conductivity	uS/cm	2000	N/A	1.0	8414429
pH	pH	7.80	N/A	N/A	8414428
Anions					
Alkalinity (PP as CaCO3)	mg/L	81	N/A	5.0	8424014
Alkalinity (Total as CaCO3)	mg/L	1500	N/A	5.0	8424014
Bicarbonate (HCO3)	mg/L	1600	N/A	5.0	8424014
Carbonate (CO3)	mg/L	97	N/A	5.0	8424014
Hydroxide (OH)	mg/L	<5.0	N/A	5.0	8424014
Dissolved Sulphate (SO4)	mg/L	730 (1)	N/A	5.0	8419026
Dissolved Chloride (Cl)	mg/L	25	N/A	1.0	8419025
Nutrients					
Dissolved Nitrite (N)	mg/L	<0.010	N/A	0.010	8414214
Dissolved Nitrate (N)	mg/L	0.016	N/A	0.010	8414214
Lab Filtered Elements					
Dissolved Aluminum (Al)	mg/L	0.016 (2)	0.012	0.0030	8415465
Dissolved Antimony (Sb)	mg/L	0.0021	0.0021	0.00060	8415465

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

(2) Duplicate exceeds acceptance criteria due to sample non homogeneity.
Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

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ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7330	PP7330		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17		
COC Number		M031856	M031856		
	UNITS	MW16-14-33	MW16-14-33 Lab-Dup	RDL	QC Batch
Dissolved Arsenic (As)	mg/L	0.0017	0.0019	0.00020	8415465
Dissolved Barium (Ba)	mg/L	3.8	N/A	1.0	8421809
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Boron (B)	mg/L	<2.0	N/A	2.0	8421809
Dissolved Cadmium (Cd)	mg/L	0.000024	0.000023	0.000020	8415465
Dissolved Calcium (Ca)	mg/L	2300	N/A	30	8421809
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Cobalt (Co)	mg/L	0.00065	0.00057	0.00030	8415465
Dissolved Copper (Cu)	mg/L	<0.00020	<0.00020	0.00020	8415465
Dissolved Iron (Fe)	mg/L	68	N/A	6.0	8421809
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	8415465
Dissolved Lithium (Li)	mg/L	<2.0	N/A	2.0	8421809
Dissolved Magnesium (Mg)	mg/L	190	N/A	20	8421809
Dissolved Manganese (Mn)	mg/L	14	N/A	0.40	8421809
Dissolved Molybdenum (Mo)	mg/L	0.028	0.028	0.00020	8415465
Dissolved Nickel (Ni)	mg/L	0.0036	0.0033	0.00050	8415465
Dissolved Phosphorus (P)	mg/L	49	N/A	10	8421809
Dissolved Potassium (K)	mg/L	53	N/A	30	8421809
Dissolved Selenium (Se)	mg/L	0.0011	0.0010	0.00020	8415465
Dissolved Silicon (Si)	mg/L	25	N/A	10	8421809
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	8415465
Dissolved Sodium (Na)	mg/L	410	N/A	50	8421809
Dissolved Strontium (Sr)	mg/L	9.7	N/A	2.0	8421809
Dissolved Sulphur (S)	mg/L	220	N/A	20	8421809
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	8415465
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Titanium (Ti)	mg/L	0.0020	0.0012	0.0010	8415465
Dissolved Uranium (U)	mg/L	0.012	0.012	0.00010	8415465
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Zinc (Zn)	mg/L	0.0036	<0.0030	0.0030	8415465

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP7330	PP7330			PP7331	PP7331		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17			2016/09/27 10:07	2016/09/27 10:07		
COC Number		M031856	M031856			M031856	M031856		
	UNITS	MW16-14-33	MW16-14-33 Lab-Dup	RDL	QC Batch	MW16-6-11	MW16-6-11 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	N/A	N/A	0.50	8417244	4.3	N/A	0.50	8417244
Lab Filtered Inorganics									
Dissolved Organic Carbon (C)	mg/L	3.9	N/A	0.50	8417248	N/A	N/A	0.50	8417248
Microbiological Param.									
E.Coli DST	mpn/100mL	<20	N/A	20	8413792	<100	N/A	100	8413792
Fecal Coliforms	MPN/100mL	<20 (1)	N/A	20	8413790	<100 (1)	N/A	100	8413790
Heterotrophic Plate Count	CFU/mL	>6000	>6000	1.0	8413793	56000 (2)	56000	100	8413793
Total Coliforms DST	mpn/100mL	2300	N/A	20	8413792	9300	N/A	100	8413792
Nutrients									
Dissolved Ammonia (N)	mg/L	N/A	N/A	N/A	8417670	0.37	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	38 (3)	N/A	2.5	8417434	6.5 (2)	N/A	0.50	8417434
Orthophosphate (P)	mg/L	0.0039	N/A	0.0030	8417135	<0.0030	N/A	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	N/A	N/A	N/A	N/A	<0.0030	N/A	0.0030	8416951
Lab Filtered Nutrients									
Dissolved Ammonia (N)	mg/L	1.5	N/A	0.050	8417688	N/A	N/A	N/A	N/A
Dissolved Phosphorus (P)	mg/L	0.0073	0.0064	0.0030	8415475	N/A	N/A	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP7332	PP7332			PP7333	PP7333		
Sampling Date		2016/09/27 09:37	2016/09/27 09:37			2016/09/27 17:50	2016/09/27 17:50		
COC Number		M031856	M031856			M031856	M031856		
	UNITS	MW16-6-20	MW16-6-20 Lab-Dup	RDL	QC Batch	MW16-7-5	MW16-7-5 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.1	N/A	0.50	8417244	9.2	N/A	0.50	8417244
Microbiological Param.									
E.Coli DST	mpn/100mL	<1.0	<1.0	1.0	8413792	<10	N/A	10	8413792
Fecal Coliforms	MPN/100mL	<1.0	<1.0	1.0	8413790	<10 (1)	N/A	10	8413790
Heterotrophic Plate Count	CFU/mL	>6000	>6000	1.0	8413793	920	1100	1.0	8413793
Total Coliforms DST	mpn/100mL	>2400	>2400	1.0	8413792	1700	N/A	10	8413792
Nutrients									
Dissolved Ammonia (N)	mg/L	0.49	N/A	0.050	8417670	0.16	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.050	8417434	0.62	N/A	0.050	8419040
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8417394	0.012 (2)	N/A	0.0030	8417135
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	8416951	0.0065	N/A	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Orthophopshate greater than dissolved phosphate. Results within acceptable limits of precision.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP7334	PP7334	PP7335	PP7335		PP7336		
Sampling Date		2016/09/27 13:10	2016/09/27 13:10	2016/09/27 13:42	2016/09/27 13:42		2016/09/27 15:36		
COC Number		M031856	M031856	M031856	M031856		M031856		
	UNITS	MW16-19-8	MW16-19-8 Lab-Dup	MW16-19-19	MW16-19-19 Lab-Dup	RDL	MW16-20-21	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	6.3	N/A	3.9	N/A	0.50	3.8	0.50	8417244
Microbiological Param.									
E.Coli DST	mpn/100mL	63	N/A	<10	N/A	10	<100	100	8413792
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	<10 (1)	N/A	10	<100 (1)	100	8413790
Heterotrophic Plate Count	CFU/mL	>6000	>6000	1700	1700	1.0	17000 (2)	100	8413793
Total Coliforms DST	mpn/100mL	280	N/A	10	N/A	10	750	100	8413792
Nutrients									
Dissolved Ammonia (N)	mg/L	0.070	N/A	1.1	N/A	0.050	0.57	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	0.70 (2)	N/A	1.5 (2)	N/A	0.50	11 (2)	0.50	8417434
Orthophosphate (P)	mg/L	<0.0030	N/A	<0.0030	N/A	0.0030	<0.0030	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	0.0037	N/A	<0.0030	N/A	0.0030	<0.0030	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PP7336		
Sampling Date		2016/09/27 15:36		
COC Number		M031856		
	UNITS	MW16-20-21 Lab-Dup	RDL	QC Batch
Microbiological Param.				
Heterotrophic Plate Count	CFU/mL	15000	100	8413793

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

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Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PP7330	PP7330	PP7331		PP7332		PP7333		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17	2016/09/27 10:07		2016/09/27 09:37		2016/09/27 17:50		
COC Number		M031856	M031856	M031856		M031856		M031856		
	UNITS	MW16-14-33	MW16-14-33 Lab-Dup	MW16-6-11	RDL	MW16-6-20	RDL	MW16-7-5	RDL	QC Batch
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	N/A	N/A	<0.0020	0.0020	<0.0020	0.0020	0.0020	0.0020	8417239
Total Mercury (Hg)	ug/L	<20 (1)	N/A	<20 (1)	20	<0.20 (1)	0.20	<2.0 (1)	2.0	8417247
Lab Filtered Elements-Low										
Dissolved Mercury (Hg)	ug/L	<0.0020	<0.0020	N/A	0.0020	N/A	N/A	N/A	N/A	8417235

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PP7334		PP7335		PP7336		
Sampling Date		2016/09/27 13:10		2016/09/27 13:42		2016/09/27 15:36		
COC Number		M031856		M031856		M031856		
	UNITS	MW16-19-8	RDL	MW16-19-19	RDL	MW16-20-21	RDL	QC Batch
Low Level Elements								
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	<0.0020	0.0020	<0.0020	0.0020	8417239
Total Mercury (Hg)	ug/L	<2.0 (1)	2.0	<0.20 (1)	0.20	<6.0 (1)	6.0	8417247

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	10.0°C
Package 2	10.3°C

Sample PP7330-01 : Cation - Anion balance exceeds normal acceptance limits. Major ions were reanalyzed due to possible matrix interference.

ROUTINE WATER & DISS. REGULATED METALS (WATER) Comments

Sample PP7330-01 Alkalinity @25C (pp, total), CO3,HCO3,OH: Detection limits raised due to sample matrix.
Sample PP7330-01 Elements by ICP-Dissolved-Lab Filtered: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8413790	RP0	Method Blank	Fecal Coliforms	2016/09/29	<1.0		MPN/10	
8413790	RP0	RPD [PP7332-09]	Fecal Coliforms	2016/09/29	NC		%	N/A
8413792	AP1	Method Blank	E.Coli DST	2016/09/29	<1.0		mpn/100	
			Total Coliforms DST	2016/09/29	<1.0		mpn/100	
8413792	AP1	RPD [PP7332-09]	E.Coli DST	2016/09/29	NC		%	N/A
			Total Coliforms DST	2016/09/29	NC		%	N/A
8413792	AP1	RPD	E.Coli DST	2016/09/29	NC		%	N/A
			Total Coliforms DST	2016/09/29	NC		%	N/A
8413793	AP1	Method Blank	Heterotrophic Plate Count	2016/09/30	<1.0		CFU/mL	
8413793	AP1	RPD [PP7330-09]	Heterotrophic Plate Count	2016/09/30	NC		%	N/A
8413793	AP1	RPD [PP7331-09]	Heterotrophic Plate Count	2016/09/30	0.72		%	N/A
8413793	AP1	RPD [PP7332-09]	Heterotrophic Plate Count	2016/09/30	NC		%	N/A
8413793	AP1	RPD [PP7333-09]	Heterotrophic Plate Count	2016/09/30	18		%	N/A
8413793	AP1	RPD [PP7334-09]	Heterotrophic Plate Count	2016/09/30	NC		%	N/A
8413793	AP1	RPD [PP7335-09]	Heterotrophic Plate Count	2016/09/30	2.4		%	N/A
8413793	AP1	RPD [PP7336-09]	Heterotrophic Plate Count	2016/09/30	6.9		%	N/A
8414214	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/09/28		102	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		NC	%	80 - 120
8414214	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/28		100	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		101	%	80 - 120
8414214	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/28	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/28	<0.010		mg/L	
8414214	JLD	RPD	Dissolved Nitrite (N)	2016/09/28	0.31		%	20
			Dissolved Nitrate (N)	2016/09/28	2.5		%	20
8414403	JLD	Matrix Spike [PP7333-01]	Dissolved Nitrite (N)	2016/09/28		102	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		103	%	80 - 120
8414403	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/28		100	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		101	%	80 - 120
8414403	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/28	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/28	<0.010		mg/L	
8414403	JLD	RPD [PP7333-01]	Dissolved Nitrite (N)	2016/09/28	NC		%	20
			Dissolved Nitrate (N)	2016/09/28	NC		%	20
8414424	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/28		94	%	80 - 120
8414424	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/28	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/28	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/28	<0.50		mg/L	
			Carbonate (CO3)	2016/09/28	<0.50		mg/L	
			Hydroxide (OH)	2016/09/28	<0.50		mg/L	
8414424	SSO	RPD [PP7332-01]	Alkalinity (PP as CaCO3)	2016/09/28	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/28	5.2		%	20
			Bicarbonate (HCO3)	2016/09/28	5.2		%	20
			Carbonate (CO3)	2016/09/28	NC		%	20
			Hydroxide (OH)	2016/09/28	NC		%	20
8414428	SSO	Spiked Blank	pH	2016/09/28		100	%	97 - 103
8414428	SSO	RPD	pH	2016/09/28	1.0		%	N/A
8414429	SSO	Spiked Blank	Conductivity	2016/09/28		101	%	90 - 110
8414429	SSO	Method Blank	Conductivity	2016/09/28	<1.0		uS/cm	
8414429	SSO	RPD [PP7332-01]	Conductivity	2016/09/28	0.25		%	20
8414668	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/09/28		90	%	80 - 120
			Dissolved Boron (B)	2016/09/28		87	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		90	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		88	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lithium (Li)	2016/09/28		91	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		96	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		89	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		99	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		91	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		87	%	80 - 120
8414668	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/09/28		92	%	80 - 120
			Dissolved Boron (B)	2016/09/28		88	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		97	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		91	%	80 - 120
			Dissolved Lithium (Li)	2016/09/28		93	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		100	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		93	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		98	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		94	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		95	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		89	%	80 - 120
8414668	JHC	Method Blank	Dissolved Barium (Ba)	2016/09/28	<0.010		mg/L	
			Dissolved Boron (B)	2016/09/28	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/09/28	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/28	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/09/28	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/09/28	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/28	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/09/28	<0.10		mg/L	
			Dissolved Potassium (K)	2016/09/28	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/09/28	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/09/28	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/09/28	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/09/28	<0.20		mg/L	
8414668	JHC	RPD	Dissolved Barium (Ba)	2016/09/28	0.0078		%	20
			Dissolved Boron (B)	2016/09/28	NC		%	20
			Dissolved Calcium (Ca)	2016/09/28	0.0054		%	20
			Dissolved Iron (Fe)	2016/09/28	NC		%	20
			Dissolved Lithium (Li)	2016/09/28	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/28	0.051		%	20
			Dissolved Manganese (Mn)	2016/09/28	0.054		%	20
			Dissolved Phosphorus (P)	2016/09/28	NC		%	20
			Dissolved Potassium (K)	2016/09/28	1.6		%	20
			Dissolved Silicon (Si)	2016/09/28	0.29		%	20
			Dissolved Sodium (Na)	2016/09/28	0.082		%	20
			Dissolved Strontium (Sr)	2016/09/28	0.0033		%	20
			Dissolved Sulphur (S)	2016/09/28	0.015		%	20
8414729	VP4	Matrix Spike [PP7330-07]	O-TERPHENYL (sur.)	2016/09/30		90	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/30		88	%	50 - 130
8414729	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/09/30		87	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/30		89	%	70 - 130
8414729	VP4	Method Blank	O-TERPHENYL (sur.)	2016/09/30		84	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/30	<0.10		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8414729	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/09/30	43 (1)		%	40
8415439	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/09/29		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/29		94	%	80 - 120
			Dissolved Arsenic (As)	2016/09/29		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/29		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/29		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/29		94	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/29		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/29		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/29		91	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/29		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/29		87	%	80 - 120
			Dissolved Selenium (Se)	2016/09/29		97	%	80 - 120
			Dissolved Silver (Ag)	2016/09/29		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/29		93	%	80 - 120
			Dissolved Tin (Sn)	2016/09/29		99	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/29		98	%	80 - 120
			Dissolved Uranium (U)	2016/09/29		88	%	80 - 120
			Dissolved Vanadium (V)	2016/09/29		95	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/29		NC	%	80 - 120
8415439	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/29		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/29		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/29		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/29		90	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/29		96	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/29		94	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/29		93	%	80 - 120
			Dissolved Copper (Cu)	2016/09/29		93	%	80 - 120
			Dissolved Lead (Pb)	2016/09/29		92	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/29		95	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/29		87	%	80 - 120
			Dissolved Selenium (Se)	2016/09/29		101	%	80 - 120
			Dissolved Silver (Ag)	2016/09/29		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/29		92	%	80 - 120
			Dissolved Tin (Sn)	2016/09/29		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/29		86	%	80 - 120
			Dissolved Uranium (U)	2016/09/29		88	%	80 - 120
			Dissolved Vanadium (V)	2016/09/29		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/29		94	%	80 - 120
8415439	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/29	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/29	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/29	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/29	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/29	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/29	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/29	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/29	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/29	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/29	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/29	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/29	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/29	<0.00010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Thallium (Tl)	2016/09/29	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/29	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/29	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/29	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/29	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/29	<0.0030		mg/L	
8415439	PC5	RPD	Dissolved Aluminum (Al)	2016/09/29	NC		%	20
			Dissolved Antimony (Sb)	2016/09/29	NC		%	20
			Dissolved Arsenic (As)	2016/09/29	10		%	20
			Dissolved Beryllium (Be)	2016/09/29	NC		%	20
			Dissolved Chromium (Cr)	2016/09/29	NC		%	20
			Dissolved Cobalt (Co)	2016/09/29	NC		%	20
			Dissolved Copper (Cu)	2016/09/29	NC		%	20
			Dissolved Lead (Pb)	2016/09/29	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/29	NC		%	20
			Dissolved Nickel (Ni)	2016/09/29	NC		%	20
			Dissolved Selenium (Se)	2016/09/29	NC		%	20
			Dissolved Silver (Ag)	2016/09/29	NC		%	20
			Dissolved Thallium (Tl)	2016/09/29	NC		%	20
			Dissolved Tin (Sn)	2016/09/29	NC		%	20
			Dissolved Titanium (Ti)	2016/09/29	NC		%	20
			Dissolved Uranium (U)	2016/09/29	NC		%	20
			Dissolved Vanadium (V)	2016/09/29	NC		%	20
			Dissolved Zinc (Zn)	2016/09/29	1.5		%	20
8415465	PC5	Matrix Spike [PP7330-01]	Dissolved Aluminum (Al)	2016/09/30		144 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		97	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		97	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		91	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		96	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		93	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		91	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		88	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		NC	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		95	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		97	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		93	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		90	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		103	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		106	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		85	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		85	%	80 - 120
8415465	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/29		99	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/29		93	%	80 - 120
			Dissolved Arsenic (As)	2016/09/29		91	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/29		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/29		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/29		94	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/29		92	%	80 - 120
			Dissolved Copper (Cu)	2016/09/29		91	%	80 - 120
			Dissolved Lead (Pb)	2016/09/29		92	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Molybdenum (Mo)	2016/09/29		92	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/29		85	%	80 - 120
			Dissolved Selenium (Se)	2016/09/29		97	%	80 - 120
			Dissolved Silver (Ag)	2016/09/29		94	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/29		93	%	80 - 120
			Dissolved Tin (Sn)	2016/09/29		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/29		90	%	80 - 120
			Dissolved Uranium (U)	2016/09/29		87	%	80 - 120
			Dissolved Vanadium (V)	2016/09/29		94	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/29		92	%	80 - 120
8415465	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/29	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/29	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/29	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/29	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/29	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/29	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/29	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/29	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/29	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/29	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/29	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/29	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/29	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/29	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/29	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/29	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/29	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/29	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/29	<0.0030		mg/L	
8415465	PC5	RPD [PP7330-01]	Dissolved Aluminum (Al)	2016/09/29	NC		%	20
			Dissolved Antimony (Sb)	2016/09/29	NC		%	20
			Dissolved Arsenic (As)	2016/09/29	14		%	20
			Dissolved Beryllium (Be)	2016/09/29	NC		%	20
			Dissolved Cadmium (Cd)	2016/09/29	NC		%	20
			Dissolved Chromium (Cr)	2016/09/29	NC		%	20
			Dissolved Cobalt (Co)	2016/09/29	NC		%	20
			Dissolved Copper (Cu)	2016/09/29	NC		%	20
			Dissolved Lead (Pb)	2016/09/29	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/29	1.5		%	20
			Dissolved Nickel (Ni)	2016/09/29	8.0		%	20
			Dissolved Selenium (Se)	2016/09/29	9.1		%	20
			Dissolved Silver (Ag)	2016/09/29	NC		%	20
			Dissolved Thallium (Tl)	2016/09/29	NC		%	20
			Dissolved Tin (Sn)	2016/09/29	NC		%	20
			Dissolved Titanium (Ti)	2016/09/29	NC		%	20
			Dissolved Uranium (U)	2016/09/29	0.20		%	20
			Dissolved Vanadium (V)	2016/09/29	NC		%	20
			Dissolved Zinc (Zn)	2016/09/29	NC		%	20
8415475	MB5	Matrix Spike [PP7330-01]	Dissolved Phosphorus (P)	2016/09/29		99	%	80 - 120
8415475	MB5	QC Standard	Dissolved Phosphorus (P)	2016/09/29		97	%	80 - 120
8415475	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/09/29		97	%	80 - 120
8415475	MB5	Method Blank	Dissolved Phosphorus (P)	2016/09/29	<0.0030		mg/L	

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8415475	MB5	RPD [PP7330-01]	Dissolved Phosphorus (P)	2016/09/29	NC		%	20
8416951	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		103	%	80 - 120
8416951	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		104	%	80 - 120
8416951	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		100	%	80 - 120
8416951	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	0.0037, RDL=0.0030		mg/L	
8416951	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	NC		%	20
8417135	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		90	%	80 - 120
8417135	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		91	%	80 - 120
8417135	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417135	MB5	RPD	Orthophosphate (P)	2016/09/30	NC		%	20
8417235	RK3	Matrix Spike [PP7330-06]	Dissolved Mercury (Hg)	2016/09/30		112	%	80 - 120
8417235	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/30		114	%	80 - 120
8417235	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417235	RK3	RPD [PP7330-06]	Dissolved Mercury (Hg)	2016/09/30	NC		%	20
8417239	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/09/30		107	%	80 - 120
8417239	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/30		112	%	80 - 120
8417239	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417239	RK3	RPD	Dissolved Mercury (Hg)	2016/09/30	NC		%	20
8417244	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/09/30		103	%	80 - 120
8417244	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/09/30		98	%	80 - 120
8417244	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/09/30	<0.50		mg/L	
8417244	MUK	RPD	Dissolved Organic Carbon (C)	2016/09/30	NC		%	20
8417247	RK3	Matrix Spike	Total Mercury (Hg)	2016/09/30		109	%	80 - 120
8417247	RK3	Spiked Blank	Total Mercury (Hg)	2016/09/30		104	%	80 - 120
8417247	RK3	Method Blank	Total Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417247	RK3	RPD	Total Mercury (Hg)	2016/09/30	NC		%	20
8417248	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/09/30		107	%	80 - 120
8417248	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/09/30		101	%	80 - 120
8417248	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/09/30	<0.50		mg/L	
8417248	MUK	RPD	Dissolved Organic Carbon (C)	2016/09/30	NC		%	20
8417394	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417394	MB5	RPD	Orthophosphate (P)	2016/09/30	1.7		%	20
8417434	RM9	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/01		NC	%	80 - 120
8417434	RM9	QC Standard	Total Kjeldahl Nitrogen	2016/10/01		111	%	80 - 120
8417434	RM9	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/01		108	%	80 - 120
8417434	RM9	Method Blank	Total Kjeldahl Nitrogen	2016/10/01	<0.050		mg/L	
8417434	RM9	RPD	Total Kjeldahl Nitrogen	2016/10/01	1.1		%	20
8417670	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	3.2		%	20
8417688	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417688	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		97	%	80 - 120
8417688	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417688	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	1.3		%	20
8417842	MZ	Matrix Spike [PP7331-08]	1,4-Difluorobenzene (sur.)	2016/10/02		105	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/02		108	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/02		128	%	70 - 130
			Benzene	2016/10/02		111	%	70 - 130

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Toluene	2016/10/02		108	%	70 - 130
			Ethylbenzene	2016/10/02		114	%	70 - 130
			m & p-Xylene	2016/10/02		117	%	70 - 130
			o-Xylene	2016/10/02		119	%	70 - 130
			F1 (C6-C10)	2016/10/02		70	%	70 - 130
8417842	MZ	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/02		107	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/02		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/02		118	%	70 - 130
			Benzene	2016/10/02		98	%	70 - 130
			Toluene	2016/10/02		98	%	70 - 130
			Ethylbenzene	2016/10/02		104	%	70 - 130
			m & p-Xylene	2016/10/02		105	%	70 - 130
			o-Xylene	2016/10/02		107	%	70 - 130
			F1 (C6-C10)	2016/10/02		98	%	70 - 130
8417842	MZ	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/02		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/02		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/02		120	%	70 - 130
			Benzene	2016/10/02	<0.00040		mg/L	
			Toluene	2016/10/02	<0.00040		mg/L	
			Ethylbenzene	2016/10/02	<0.00040		mg/L	
			m & p-Xylene	2016/10/02	<0.00080		mg/L	
			o-Xylene	2016/10/02	<0.00040		mg/L	
			Xylenes (Total)	2016/10/02	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/02	<0.10		mg/L	
			F1 (C6-C10)	2016/10/02	<0.10		mg/L	
8417842	MZ	RPD [PP7330-08]	Benzene	2016/10/02	NC		%	40
			Toluene	2016/10/02	NC		%	40
			Ethylbenzene	2016/10/02	NC		%	40
			m & p-Xylene	2016/10/02	NC		%	40
			o-Xylene	2016/10/02	NC		%	40
			Xylenes (Total)	2016/10/02	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/02	NC		%	40
			F1 (C6-C10)	2016/10/02	NC		%	40
8418338	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/01		108	%	80 - 120
8418338	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/01		107	%	80 - 120
8418338	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/01	1.2, RDL=1.0		mg/L	
8418338	ZI	RPD	Dissolved Chloride (Cl)	2016/10/01	1.6		%	20
8418346	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/01		119	%	80 - 120
8418346	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/01		101	%	80 - 120
8418346	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/01	<1.0		mg/L	
8418346	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/01	NC		%	20
8419025	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/02		NC	%	80 - 120
8419025	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/02		107	%	80 - 120
8419025	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/02	<1.0		mg/L	
8419025	KP9	RPD	Dissolved Chloride (Cl)	2016/10/02	0.44		%	20
8419026	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/02		111	%	80 - 120
8419026	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/02		103	%	80 - 120
8419026	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/02	<1.0		mg/L	
8419026	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/02	NC		%	20
8419040	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		105	%	80 - 120
8419040	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		88	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8419040	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		109	%	80 - 120
8419040	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419040	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	NC		%	20
8421809	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		104	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		100	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		95	%	80 - 120
8421809	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		100	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		103	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		96	%	80 - 120
8421809	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/05	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/05	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/05	<0.20		mg/L	
8421809	JHC	RPD	Dissolved Barium (Ba)	2016/10/05	NC		%	20
			Dissolved Boron (B)	2016/10/05	NC		%	20
			Dissolved Calcium (Ca)	2016/10/05	NC		%	20
			Dissolved Iron (Fe)	2016/10/05	NC		%	20
			Dissolved Lithium (Li)	2016/10/05	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/05	NC		%	20
			Dissolved Manganese (Mn)	2016/10/05	NC		%	20
			Dissolved Phosphorus (P)	2016/10/05	NC		%	20
			Dissolved Potassium (K)	2016/10/05	NC		%	20
			Dissolved Silicon (Si)	2016/10/05	NC		%	20
			Dissolved Sodium (Na)	2016/10/05	NC		%	20
			Dissolved Strontium (Sr)	2016/10/05	NC		%	20

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Client Project #: 110773396
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sulphur (S)	2016/10/05	NC		%	20
8424014	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/06		92	%	80 - 120
8424014	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/06	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/06	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/06	<0.50		mg/L	
			Carbonate (CO3)	2016/10/06	<0.50		mg/L	
			Hydroxide (OH)	2016/10/06	<0.50		mg/L	
8424014	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/06	3.1		%	20
			Alkalinity (Total as CaCO3)	2016/10/06	0.30		%	20
			Bicarbonate (HCO3)	2016/10/06	0.22		%	20
			Carbonate (CO3)	2016/10/06	3.1		%	20
			Hydroxide (OH)	2016/10/06	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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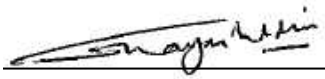
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

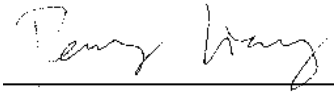
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics



Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1200

Maxxam A Bureau Veritas Group Company

Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD M 031856

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required	
Company:	Stantec Consulting Ltd.	Company:		Quotation #:		☑ 5 - 7 Days Regular (Most analyses)	
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address:	10160 112 St, Edmonton AB, T5K 2L6	Address:		Project #:	110773396	Rush TAT (Surcharges will be applied)	
Phone:	(780) 969-2223	Phone:		Site Location:	Springbank SR1	☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days	
Email:	Dylan.King@stantec.com	Email:		Site #:		Date Required:	
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet	Rush Confirmation #:	

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	8	10	12
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	8	11	12
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Regulatory Criteria

☑ AT1/CCME
☑ Drinking Water
☐ Saskatchewan
☐ D50 (Drilling Waste)
☐ Other:

Analysis Requested

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Dis ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	Phosphate	Dissolved ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-14-33		2016/09/27	17:17	W	13		✓		✓	✓	✓		8	10	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-6-11			10:07										8	9	9										
3	MW16-6-20			9:37										10	10	10										
4	MW16-7-5			17:50										9	9	10										
5	MW16-19-8			13:10										8	10	11										
6	MW16-19-19			13:42										8	9	9										
7	MW16-20-21			15:36										9	11	11										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Special Instructions

MW16-14-33 dissolved parameters not field filtered or preserved due to turbidity and low water volume

Submitted same day as sampled

Unused metals bottles present in some sample bags

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/27	18:51	[signature] Gurjeet Cirewal	2016/09/27	18:56

27-Sep-16 18:56
Wendy Sears
B684487
NB6 INS-0001

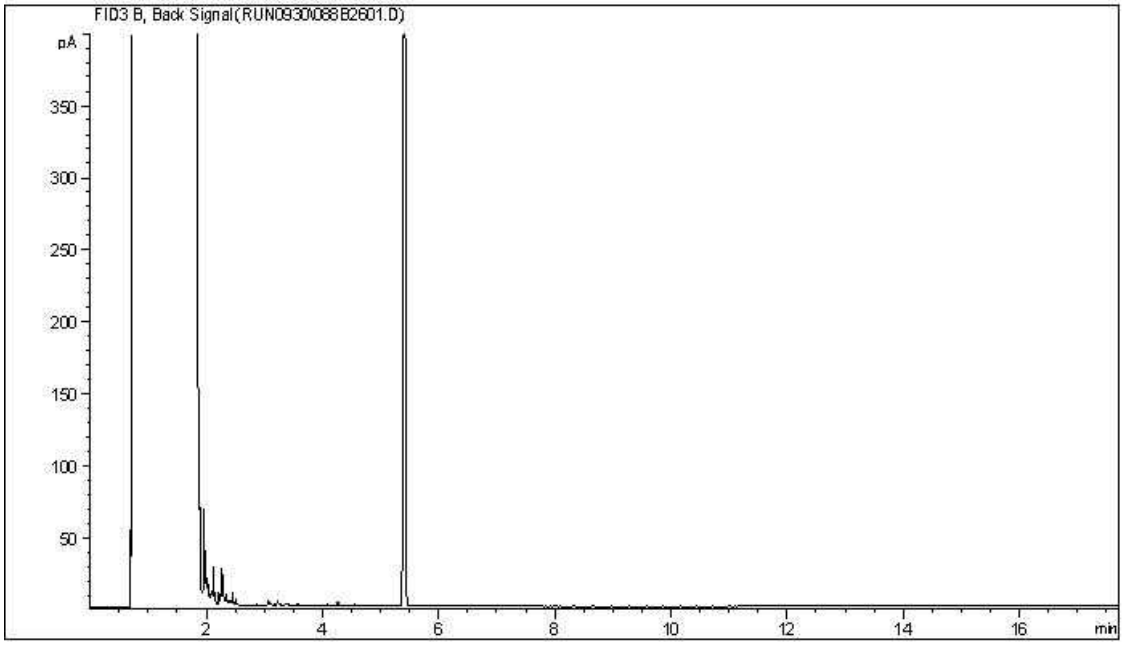
AB FCD-00331/6

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7330

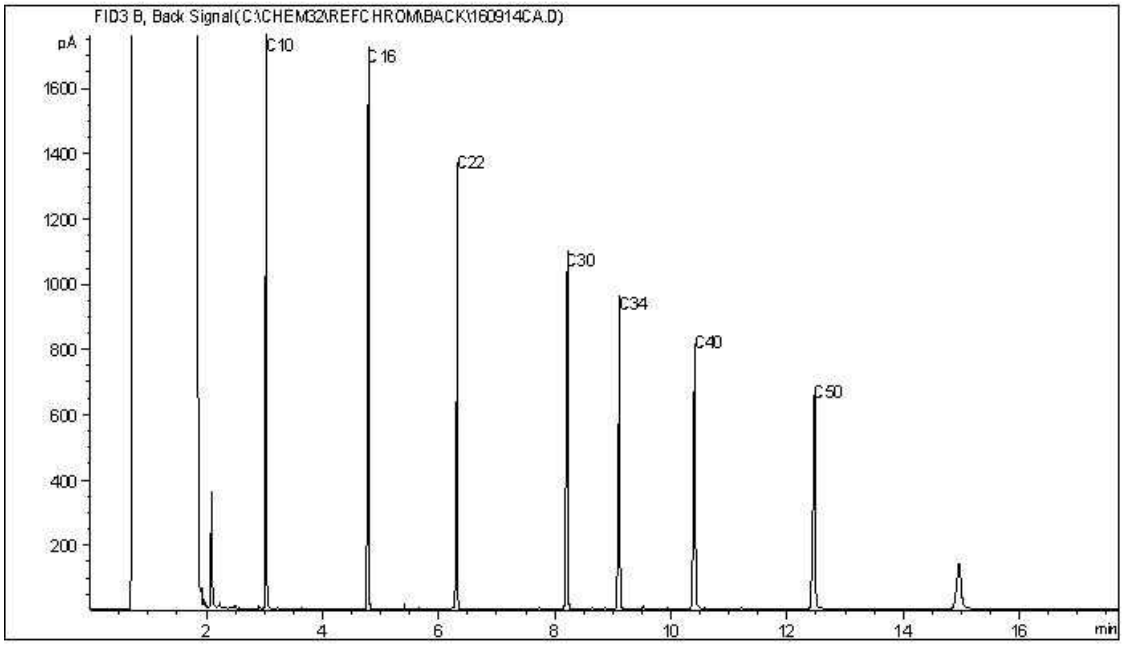
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-14-33

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

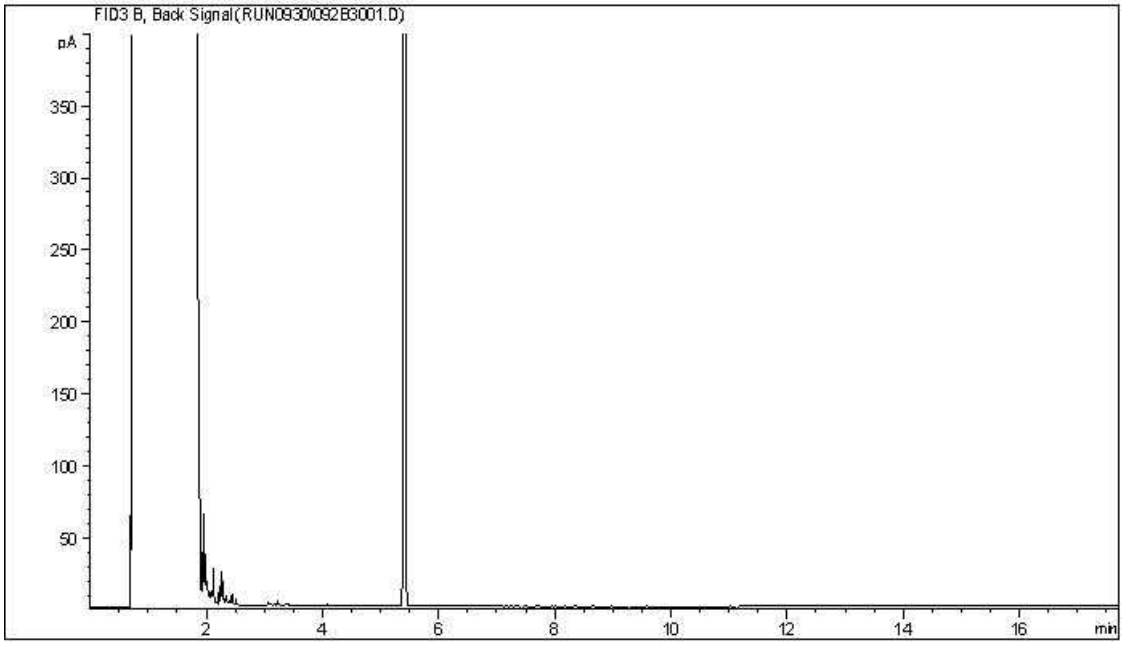
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7331

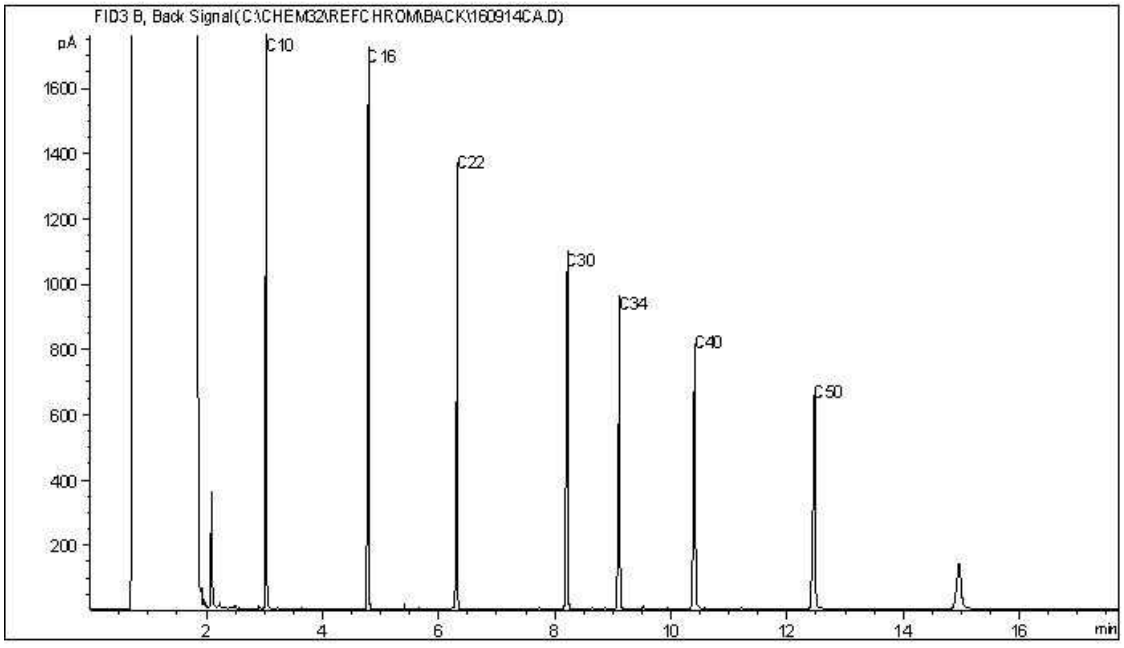
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-6-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

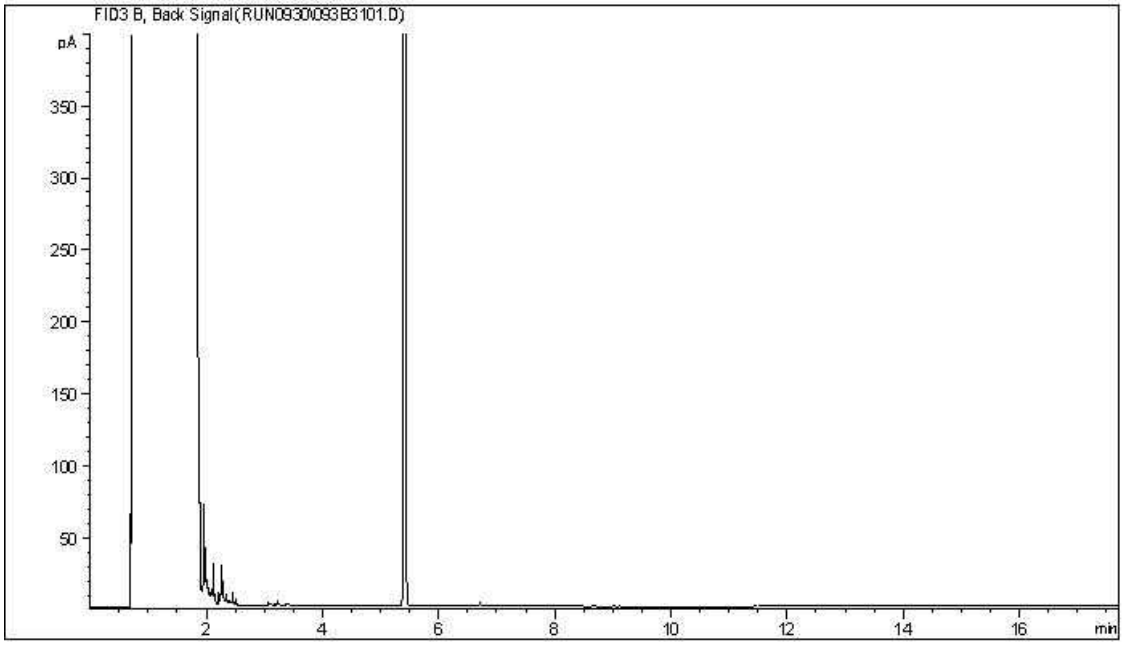
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7332

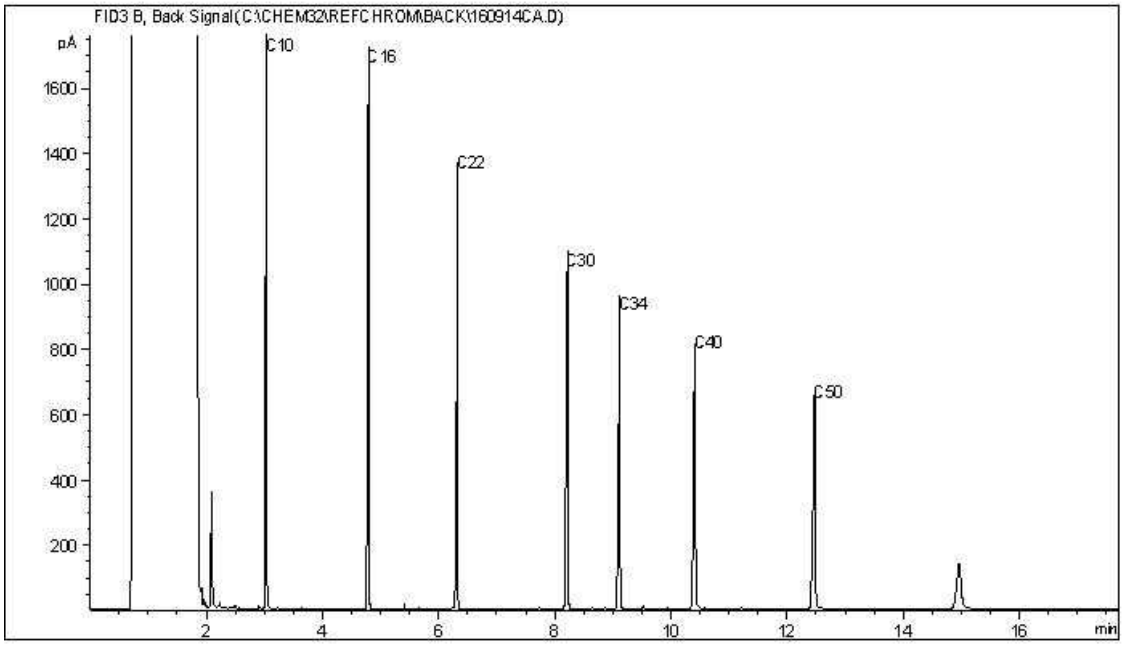
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-6-20

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

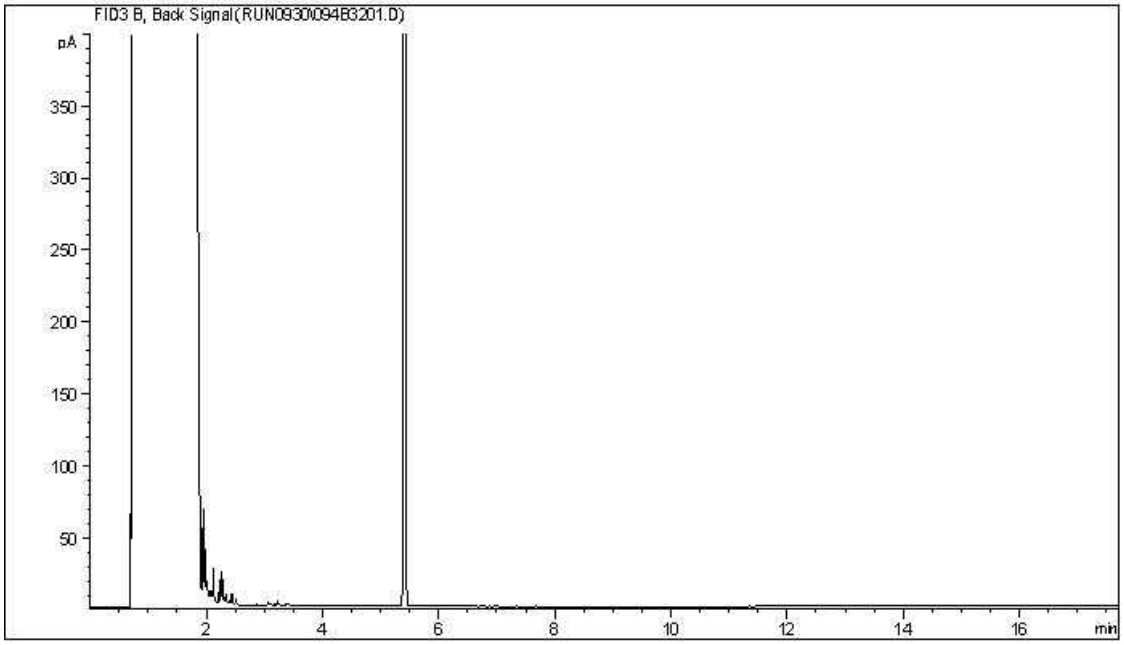
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7333

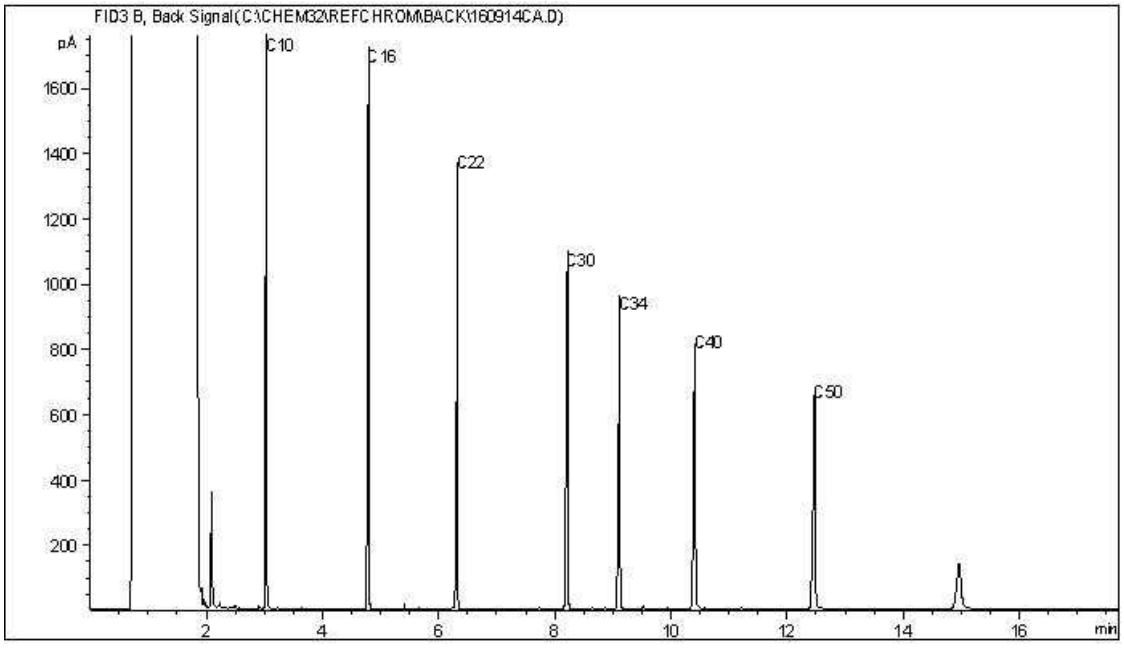
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-7-5

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

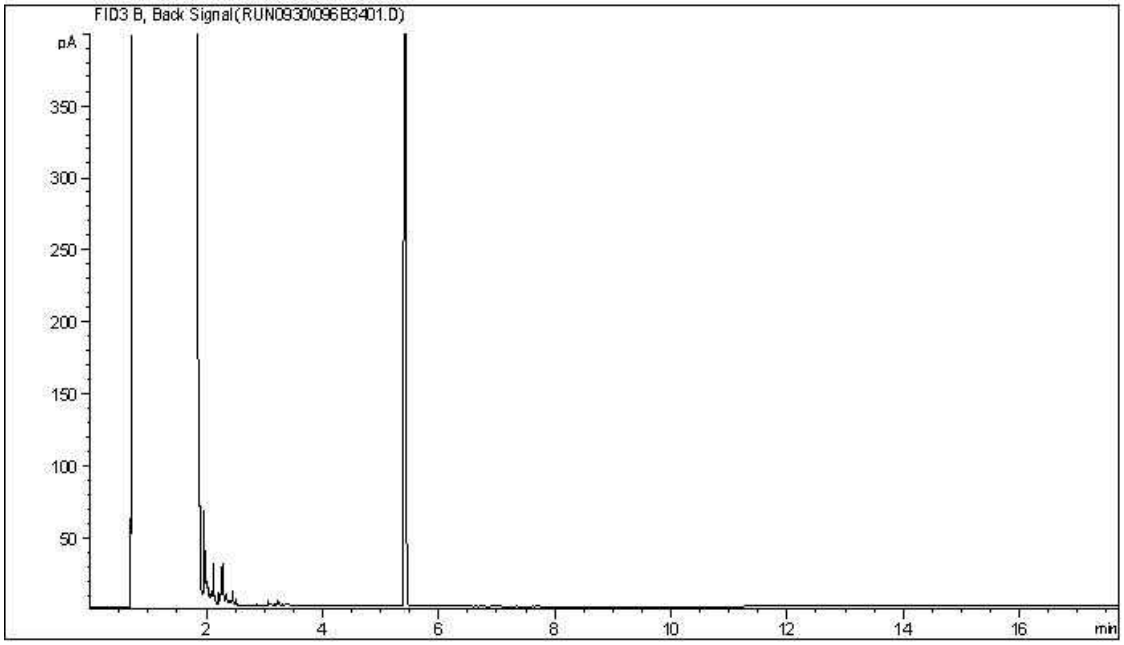
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7334

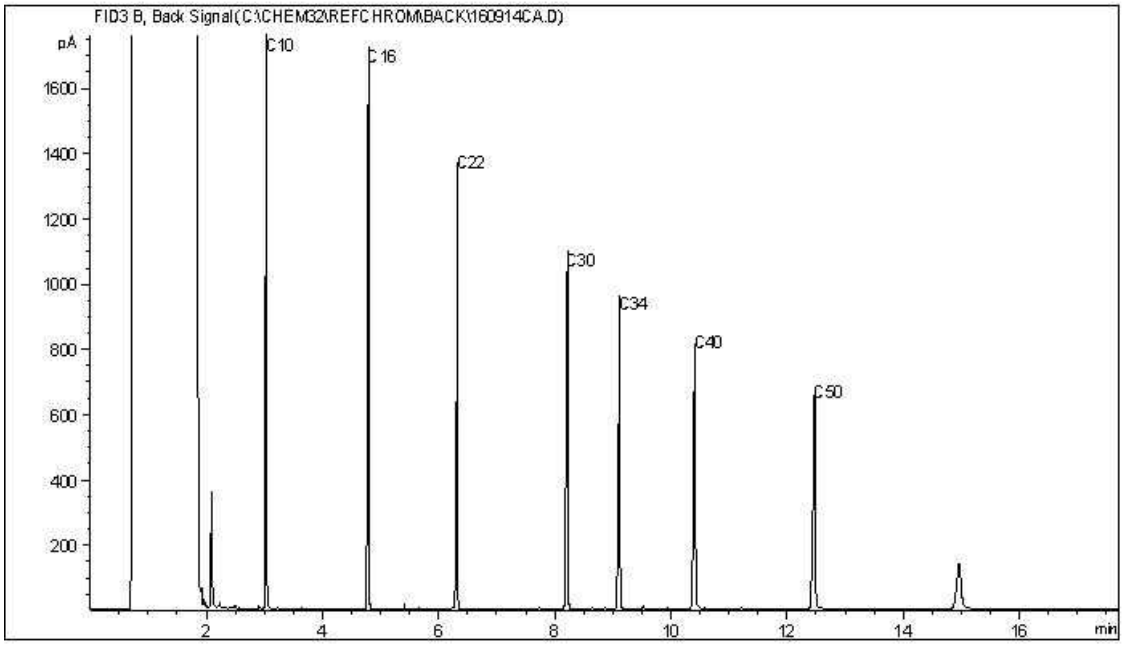
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-19-8

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

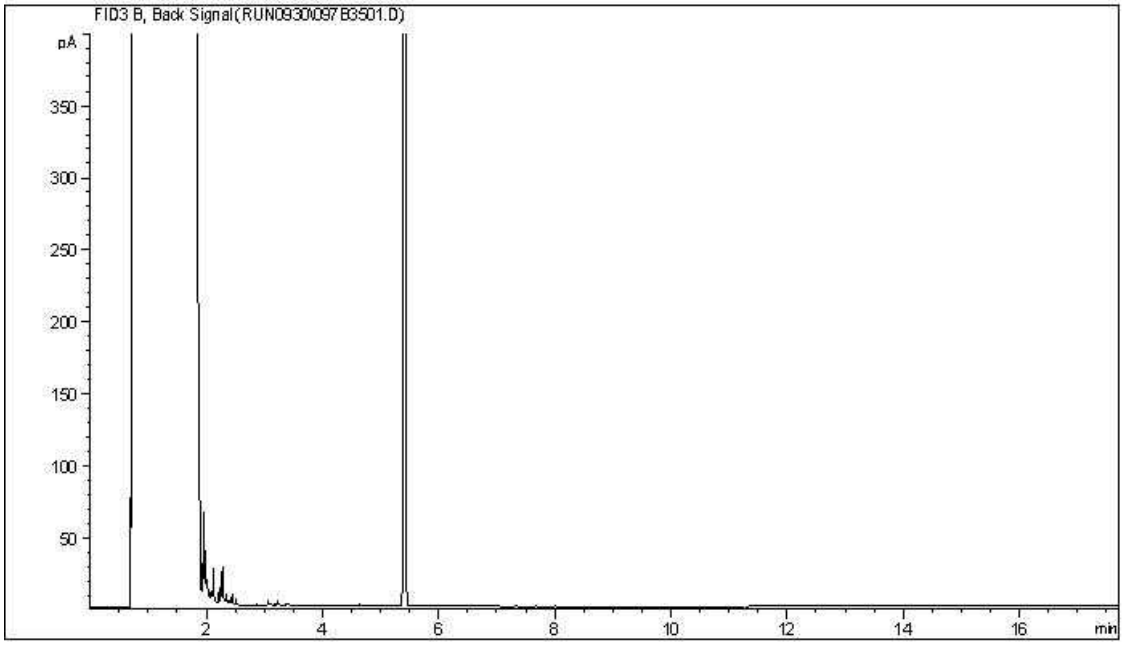
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7335

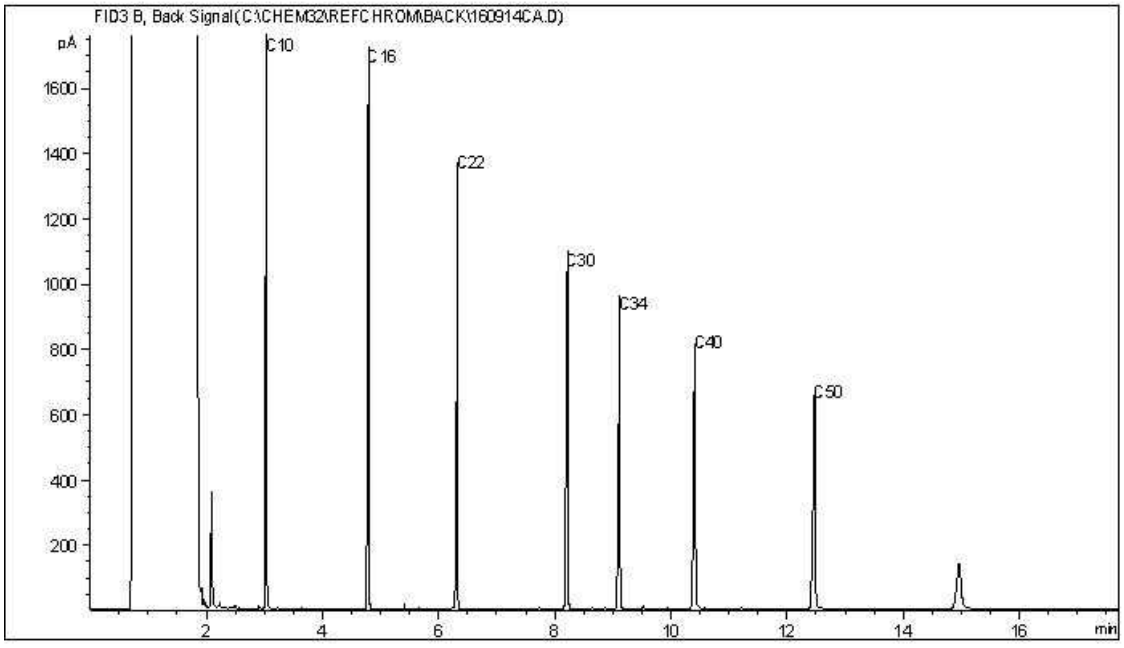
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-19-19

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

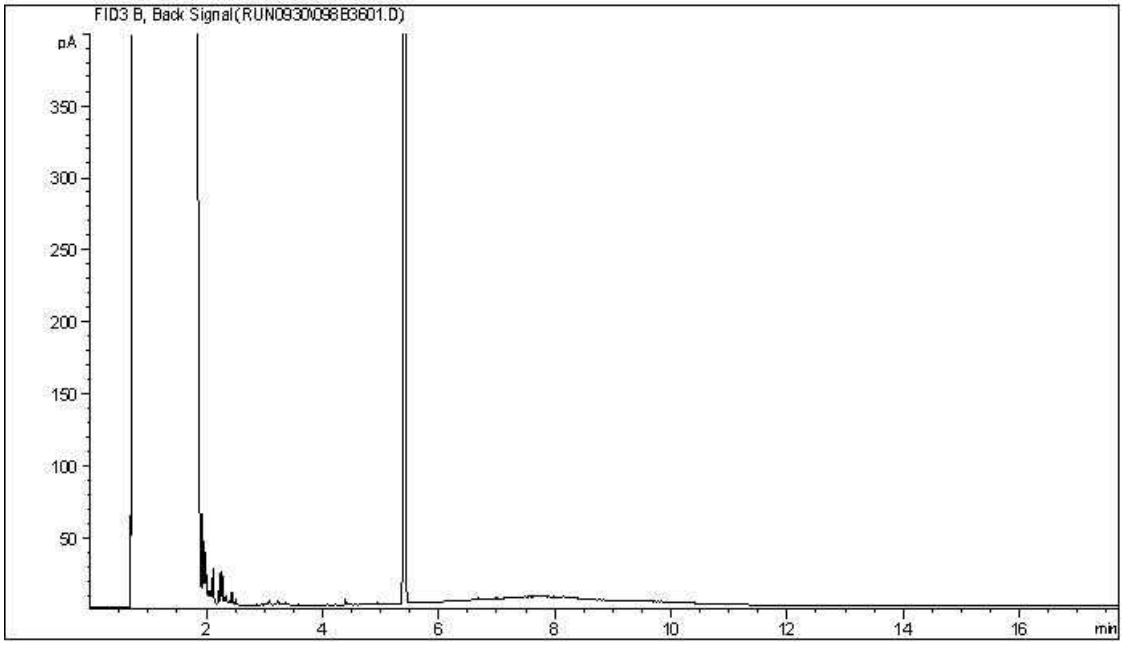
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7336

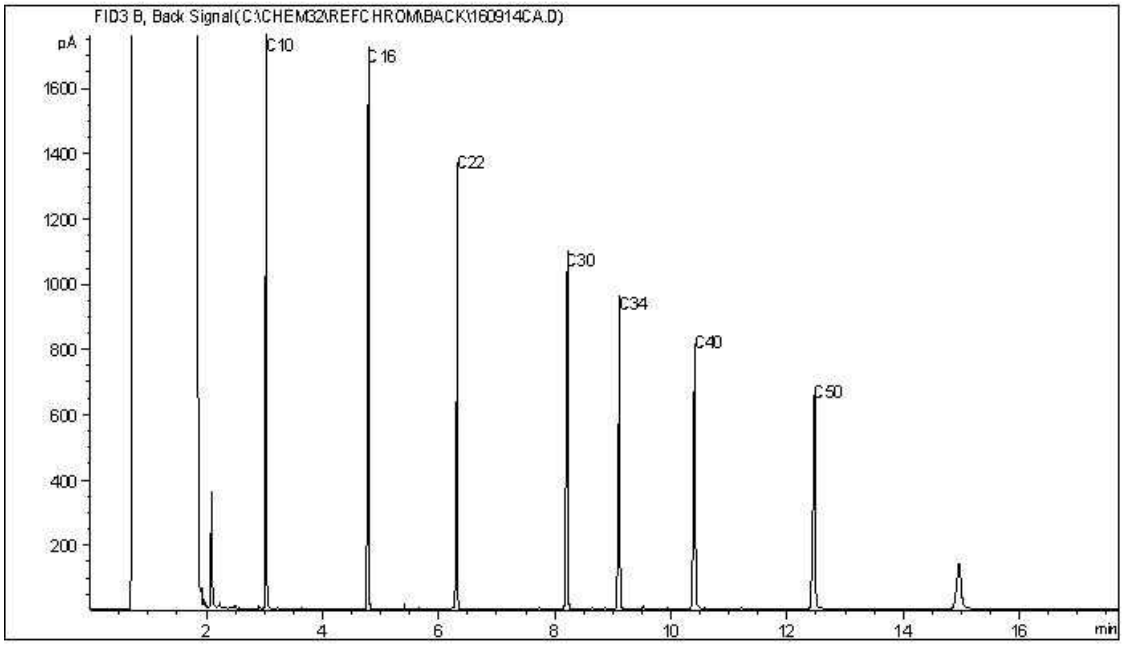
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-20-21

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031857

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/07
Report #: R2278053
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B685593
Received: 2016/09/29, 19:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	3	N/A	2016/09/30	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	3	N/A	2016/10/06	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	3	N/A	2016/10/03	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	3	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	3	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	2	N/A	2016/10/01	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	1	N/A	2016/10/01	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	3	N/A	2016/09/30	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	3	2016/09/30	2016/10/02	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	3	N/A	2016/10/04	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	2	2016/10/03	2016/10/03	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	3	2016/10/03	2016/10/03	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	2	N/A	2016/10/01	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/01	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	2	N/A	2016/09/30	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/04	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	3	N/A	2016/09/30	AB WI-00065	Auto Calc
Sum of cations, anions	3	N/A	2016/10/04	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	2	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	1	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	3	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	3	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	3	N/A	2016/10/01	AB SOP-00023	SM 22 4110 B m
pH @25°C	3	N/A	2016/09/30	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	3	N/A	2016/09/30	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	3	N/A	2016/10/03	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	3	2016/09/30	2016/10/02	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	3	N/A	2016/10/04	AB WI-00065	Auto Calc

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031857

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/07
Report #: R2278053
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B685593
Received: 2016/09/29, 19:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Kjeldahl Nitrogen	1	2016/09/30	2016/10/01	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	2	2016/10/02	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	2	2016/10/02	2016/10/04	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	1	2016/09/30	2016/10/01	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PQ3527	PQ3527	PQ3528	PQ3529	PQ3529		
Sampling Date		2016/09/29 09:52	2016/09/29 09:52	2016/09/29 16:56	2016/09/29 17:32	2016/09/29 17:32		
COC Number		M031857	M031857	M031857	M031857	M031857		
	UNITS	MW16-21-11	MW16-21-11 Lab-Dup	MW16-23-36	MW16-23-14	MW16-23-14 Lab-Dup	RDL	QC Batch
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	0.10	8416876
Volatiles								
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	N/A	0.00040	8421839
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	N/A	0.00040	8421839
Ethylbenzene	mg/L	0.00059	0.00058	<0.00040	<0.00040	N/A	0.00040	8421839
m & p-Xylene	mg/L	0.00090	0.00093	<0.00080	<0.00080	N/A	0.00080	8421839
o-Xylene	mg/L	0.0010	0.0010	<0.00040	<0.00040	N/A	0.00040	8421839
Xylenes (Total)	mg/L	0.0019	0.0019	<0.00080	<0.00080	N/A	0.00080	8421839
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	N/A	0.10	8421839
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	N/A	0.10	8421839
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	110	112	106	112	N/A	N/A	8421839
4-Bromofluorobenzene (sur.)	%	105	105	107	104	N/A	N/A	8421839
D4-1,2-Dichloroethane (sur.)	%	104	109	121	105	N/A	N/A	8421839
O-TERPHENYL (sur.)	%	93	N/A	94	92	90	N/A	8416876

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3527		PQ3529		
Sampling Date		2016/09/29 09:52		2016/09/29 17:32		
COC Number		M031857		M031857		
	UNITS	MW16-21-11	QC Batch	MW16-23-14	RDL	QC Batch
Calculated Parameters						
Anion Sum	meq/L	9.2	8416540	13	N/A	8416540
Cation Sum	meq/L	9.9	8416540	14	N/A	8416540
Hardness (CaCO3)	mg/L	440	8416386	540	0.50	8416386
Ion Balance	N/A	1.1	8416402	1.0	0.010	8416402
Dissolved Nitrate (NO3)	mg/L	21	8416387	<0.044	0.044	8416387
Nitrate plus Nitrite (N)	mg/L	4.8	8416388	<0.020	0.020	8416388
Dissolved Nitrite (NO2)	mg/L	<0.033	8416387	<0.033	0.033	8416387
Calculated Total Dissolved Solids	mg/L	480	8416403	680	10	8416403
Misc. Inorganics						
Conductivity	uS/cm	800	8417189	1100	1.0	8417175
pH	pH	7.96	8417188	7.94	N/A	8417173
Anions						
Alkalinity (PP as CaCO3)	mg/L	<0.50	8417181	<0.50	0.50	8417160
Alkalinity (Total as CaCO3)	mg/L	390	8417181	600	0.50	8417160
Bicarbonate (HCO3)	mg/L	470	8417181	730	0.50	8417160
Carbonate (CO3)	mg/L	<0.50	8417181	<0.50	0.50	8417160
Hydroxide (OH)	mg/L	<0.50	8417181	<0.50	0.50	8417160
Dissolved Sulphate (SO4)	mg/L	50	8419569	70	1.0	8419569
Dissolved Chloride (Cl)	mg/L	4.6	8419564	3.5	1.0	8419564
Nutrients						
Dissolved Nitrite (N)	mg/L	<0.010	8417625	<0.010	0.010	8417633
Dissolved Nitrate (N)	mg/L	4.8	8417625	<0.010	0.010	8417633
Elements						
Dissolved Aluminum (Al)	mg/L	0.0033	8417228	<0.0030	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	8417228	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.00045	8417228	0.0056	0.00020	8417228
Dissolved Barium (Ba)	mg/L	0.087	8417829	0.12	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.061	8417829	0.13	0.020	8417829
Dissolved Cadmium (Cd)	mg/L	0.000073	8417228	0.000033	0.000020	8417228

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3527		PQ3529		
Sampling Date		2016/09/29 09:52		2016/09/29 17:32		
COC Number		M031857		M031857		
	UNITS	MW16-21-11	QC Batch	MW16-23-14	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	86	8417829	130	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	0.00062	8417228	0.0020	0.00030	8417228
Dissolved Copper (Cu)	mg/L	0.0013	8417228	<0.00020	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.078	8417829	0.50	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.028	8417829	0.032	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	54	8417829	53	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.17	8417829	0.75	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.0010	8417228	0.0053	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	0.0016	8417228	0.0053	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	8417829	<0.10	0.10	8417829
Dissolved Potassium (K)	mg/L	7.6	8417829	6.5	0.30	8417829
Dissolved Selenium (Se)	mg/L	0.0019	8417228	<0.00020	0.00020	8417228
Dissolved Silicon (Si)	mg/L	4.7	8417829	6.5	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	8417228	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	21	8417829	59	0.50	8417829
Dissolved Strontium (Sr)	mg/L	1.1	8417829	1.1	0.020	8417829
Dissolved Sulphur (S)	mg/L	19	8417829	25	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.0067	8417228	0.0052	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	8417228	<0.0030	0.0030	8417228
RDL = Reportable Detection Limit						

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3528		
Sampling Date		2016/09/29 16:56		
COC Number		M031857		
	UNITS	MW16-23-36	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	14	N/A	8416540
Cation Sum	meq/L	14	N/A	8416540
Hardness (CaCO3)	mg/L	180	0.50	8416386
Ion Balance	N/A	0.99	0.010	8416402
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8416387
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8416388
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8416387
Calculated Total Dissolved Solids	mg/L	850	10	8416403
Misc. Inorganics				
Conductivity	uS/cm	1300	1.0	8417175
pH	pH	8.22	N/A	8417173
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8417160
Alkalinity (Total as CaCO3)	mg/L	290	0.50	8417160
Bicarbonate (HCO3)	mg/L	350	0.50	8417160
Carbonate (CO3)	mg/L	<0.50	0.50	8417160
Hydroxide (OH)	mg/L	<0.50	0.50	8417160
Dissolved Sulphate (SO4)	mg/L	380 (1)	2.0	8419569
Dissolved Chloride (Cl)	mg/L	3.2	1.0	8419564
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8417633
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8417633
Lab Filtered Elements				
Dissolved Aluminum (Al)	mg/L	0.0074	0.0030	8419977
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8419977
Dissolved Arsenic (As)	mg/L	0.00035	0.00020	8419977
Dissolved Barium (Ba)	mg/L	0.030	0.010	8417669
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8419977
Dissolved Boron (B)	mg/L	0.086	0.020	8417669

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3528		
Sampling Date		2016/09/29 16:56		
COC Number		M031857		
	UNITS	MW16-23-36	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8419977
Dissolved Calcium (Ca)	mg/L	50	0.30	8417669
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8419977
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8419977
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8419977
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8417669
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8419977
Dissolved Lithium (Li)	mg/L	0.066	0.020	8417669
Dissolved Magnesium (Mg)	mg/L	14	0.20	8417669
Dissolved Manganese (Mn)	mg/L	0.083	0.0040	8417669
Dissolved Molybdenum (Mo)	mg/L	0.0023	0.00020	8419977
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8419977
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8417669
Dissolved Potassium (K)	mg/L	4.2	0.30	8417669
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8419977
Dissolved Silicon (Si)	mg/L	3.8	0.10	8417669
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8419977
Dissolved Sodium (Na)	mg/L	230	0.50	8417669
Dissolved Strontium (Sr)	mg/L	0.77	0.020	8417669
Dissolved Sulphur (S)	mg/L	120	0.20	8417669
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8419977
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8419977
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8419977
Dissolved Uranium (U)	mg/L	0.00010	0.00010	8419977
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8419977
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8419977
RDL = Reportable Detection Limit				

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ3527	PQ3527			PQ3528	PQ3528		
Sampling Date		2016/09/29 09:52	2016/09/29 09:52			2016/09/29 16:56	2016/09/29 16:56		
COC Number		M031857	M031857			M031857	M031857		
	UNITS	MW16-21-11	MW16-21-11 Lab-Dup	RDL	QC Batch	MW16-23-36	MW16-23-36 Lab-Dup	RDL	QC Batch
Lab Filtered Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.8	N/A	0.50	8418324	2.9	3.1	0.50	8418324
Microbiological Param.									
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	8416950	11	N/A	1.0	8416950
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	8416953	5.1	N/A	1.0	8416953
Heterotrophic Plate Count	CFU/mL	3200 (2)	3100	10	8416947	400	430	1.0	8416947
Total Coliforms DST	mpn/100mL	20 (1)	N/A	10	8416950	520	N/A	1.0	8416950
Nutrients									
Total Kjeldahl Nitrogen	mg/L	3.3 (1)	N/A	0.50	8417434	1.3	N/A	0.050	8419036
Orthophosphate (P)	mg/L	0.0041 (3)	N/A	0.0030	8417394	0.0040 (3)	N/A	0.0030	8417394
Lab Filtered Nutrients									
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	8417688	0.83	0.82	0.050	8417688
Dissolved Phosphorus (P)	mg/L	0.013	N/A	0.0030	8418959	0.013	N/A	0.0030	8418959

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(3) Orthophosphate greater than total phosphate. Results within acceptable limits of precision.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ3529	PQ3529		
Sampling Date		2016/09/29 17:32	2016/09/29 17:32		
COC Number		M031857	M031857		
	UNITS	MW16-23-14	MW16-23-14 Lab-Dup	RDL	QC Batch
Misc. Inorganics					
Dissolved Organic Carbon (C)	mg/L	4.1	N/A	0.50	8418321
Microbiological Param.					
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	8416950
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	8416953
Heterotrophic Plate Count	CFU/mL	20000 (2)	20000	10	8416947
Total Coliforms DST	mpn/100mL	>2400 (1)	N/A	10	8416950
Nutrients					
Dissolved Ammonia (N)	mg/L	0.14	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	2.8 (3)	N/A	0.25	8419031
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	8416975

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PQ3527		PQ3528		PQ3529		
Sampling Date		2016/09/29 09:52		2016/09/29 16:56		2016/09/29 17:32		
COC Number		M031857		M031857		M031857		
	UNITS	MW16-21-11	RDL	MW16-23-36	RDL	MW16-23-14	RDL	QC Batch
Low Level Elements								
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	N/A	0.0020	<0.0020	0.0020	8419725
Total Mercury (Hg)	ug/L	<20 (1)	20	<0.20 (1)	0.20	<20 (1)	20	8419734
Lab Filtered Elements-Low								
Dissolved Mercury (Hg)	ug/L	N/A	N/A	<0.0020	0.0020	N/A	N/A	8417235

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	12.0°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8416876	MHF	Matrix Spike	O-TERPHENYL (sur.)	2016/10/02		95	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/02		94	%	50 - 130
8416876	MHF	Spiked Blank	O-TERPHENYL (sur.)	2016/10/02		95	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/02		94	%	70 - 130
8416876	MHF	Method Blank	O-TERPHENYL (sur.)	2016/10/02		93	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/02	<0.10		mg/L	
8416876	MHF	RPD [PQ3529-06]	F2 (C10-C16 Hydrocarbons)	2016/10/02	NC		%	40
8416947	GK1	Method Blank	Heterotrophic Plate Count	2016/10/02	<1.0		CFU/mL	
8416947	GK1	RPD [PQ3527-08]	Heterotrophic Plate Count	2016/10/02	3.5		%	N/A
8416947	GK1	RPD [PQ3528-08]	Heterotrophic Plate Count	2016/10/02	6.8		%	N/A
8416947	GK1	RPD [PQ3529-08]	Heterotrophic Plate Count	2016/10/02	0.60		%	N/A
8416947	GK1	RPD	Heterotrophic Plate Count	2016/10/02	2.2		%	N/A
			Heterotrophic Plate Count	2016/10/02	5.4		%	N/A
			Heterotrophic Plate Count	2016/10/02	4.3		%	N/A
			Heterotrophic Plate Count	2016/10/02	1.5		%	N/A
			Heterotrophic Plate Count	2016/10/02	NC		%	N/A
8416950	GK1	Method Blank	E.Coli DST	2016/10/01	<1.0		mpn/100	
			Total Coliforms DST	2016/10/01	<1.0		mpn/100	
8416950	GK1	RPD	Total Coliforms DST	2016/10/01	NC		%	N/A
8416953	GK1	Method Blank	Fecal Coliforms	2016/10/01	<1.0		MPN/10	
8416953	GK1	RPD	Fecal Coliforms	2016/10/01	NC		%	N/A
8416975	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		98	%	80 - 120
8416975	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		0.0	%	N/A
8416975	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		102	%	80 - 120
8416975	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	<0.0030		mg/L	
8416975	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	3.0		%	20
8417160	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/30		97	%	80 - 120
8417160	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/30	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/30	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/30	<0.50		mg/L	
			Carbonate (CO3)	2016/09/30	<0.50		mg/L	
			Hydroxide (OH)	2016/09/30	<0.50		mg/L	
8417160	SSO	RPD	Alkalinity (PP as CaCO3)	2016/09/30	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/30	0.14		%	20
			Bicarbonate (HCO3)	2016/09/30	0.14		%	20
			Carbonate (CO3)	2016/09/30	NC		%	20
			Hydroxide (OH)	2016/09/30	NC		%	20
8417173	SSO	Spiked Blank	pH	2016/09/30		101	%	97 - 103
8417173	SSO	RPD	pH	2016/09/30	0.19		%	N/A
8417175	SSO	Spiked Blank	Conductivity	2016/09/30		100	%	90 - 110
8417175	SSO	Method Blank	Conductivity	2016/09/30	<1.0		uS/cm	
8417175	SSO	RPD	Conductivity	2016/09/30	0.12		%	20
8417181	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/30		97	%	80 - 120
8417181	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/30	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/30	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/30	<0.50		mg/L	
			Carbonate (CO3)	2016/09/30	<0.50		mg/L	
			Hydroxide (OH)	2016/09/30	<0.50		mg/L	
8417181	SSO	RPD	Alkalinity (PP as CaCO3)	2016/09/30	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/30	0.47		%	20
			Bicarbonate (HCO3)	2016/09/30	0.47		%	20
			Carbonate (CO3)	2016/09/30	NC		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Hydroxide (OH)	2016/09/30	NC		%	20
8417188	SSO	Spiked Blank	pH	2016/09/30		101	%	97 - 103
8417188	SSO	RPD	pH	2016/09/30	0.23		%	N/A
8417189	SSO	Spiked Blank	Conductivity	2016/09/30		99	%	90 - 110
8417189	SSO	Method Blank	Conductivity	2016/09/30	<1.0		uS/cm	
8417189	SSO	RPD	Conductivity	2016/09/30	0.13		%	20
8417228	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/09/30		104	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		87	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		94	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		92	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		88	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		89	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		96	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		94	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		94	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		91	%	80 - 120
8417228	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/30		105	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		90	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		93	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		88	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		95	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		91	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		100	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		93	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		89	%	80 - 120
8417228	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/30	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/30	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/30	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/30	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/30	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/30	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/30	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/30	<0.00020		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lead (Pb)	2016/09/30	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/30	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/30	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/30	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/30	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/30	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/30	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/30	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/30	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/30	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/30	<0.0030		mg/L	
8417228	PC5	RPD	Dissolved Aluminum (Al)	2016/09/30	NC		%	20
			Dissolved Antimony (Sb)	2016/09/30	NC		%	20
			Dissolved Arsenic (As)	2016/09/30	2.8		%	20
			Dissolved Beryllium (Be)	2016/09/30	NC		%	20
			Dissolved Cadmium (Cd)	2016/09/30	NC		%	20
			Dissolved Chromium (Cr)	2016/09/30	NC		%	20
			Dissolved Cobalt (Co)	2016/09/30	NC		%	20
			Dissolved Copper (Cu)	2016/09/30	NC		%	20
			Dissolved Lead (Pb)	2016/09/30	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/30	6.0		%	20
			Dissolved Nickel (Ni)	2016/09/30	NC		%	20
			Dissolved Selenium (Se)	2016/09/30	NC		%	20
			Dissolved Silver (Ag)	2016/09/30	NC		%	20
			Dissolved Thallium (Tl)	2016/09/30	NC		%	20
			Dissolved Tin (Sn)	2016/09/30	NC		%	20
			Dissolved Titanium (Ti)	2016/09/30	NC		%	20
			Dissolved Uranium (U)	2016/09/30	NC		%	20
			Dissolved Vanadium (V)	2016/09/30	NC		%	20
			Dissolved Zinc (Zn)	2016/09/30	NC		%	20
8417235	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/09/30		112	%	80 - 120
8417235	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/30		114	%	80 - 120
8417235	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417235	RK3	RPD	Dissolved Mercury (Hg)	2016/09/30	NC		%	20
8417394	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417394	MB5	RPD	Orthophosphate (P)	2016/09/30	1.7		%	20
8417434	RM9	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/01		NC	%	80 - 120
8417434	RM9	QC Standard	Total Kjeldahl Nitrogen	2016/10/01		111	%	80 - 120
8417434	RM9	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/01		108	%	80 - 120
8417434	RM9	Method Blank	Total Kjeldahl Nitrogen	2016/10/01	<0.050		mg/L	
8417434	RM9	RPD	Total Kjeldahl Nitrogen	2016/10/01	1.1		%	20
8417625	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/09/30		101	%	80 - 120
			Dissolved Nitrate (N)	2016/09/30		NC	%	80 - 120
8417625	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/30		99	%	80 - 120
			Dissolved Nitrate (N)	2016/09/30		102	%	80 - 120
8417625	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/30	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/30	<0.010		mg/L	
8417625	JLD	RPD	Dissolved Nitrite (N)	2016/09/30	NC		%	20
			Dissolved Nitrate (N)	2016/09/30	0.57		%	20
8417633	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/10/01		102	%	80 - 120

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			Dissolved Nitrate (N)	2016/10/01		103	%	80 - 120
8417633	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/10/01		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/01		102	%	80 - 120
8417633	JLD	Method Blank	Dissolved Nitrite (N)	2016/10/01	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/01	<0.010		mg/L	
8417633	JLD	RPD	Dissolved Nitrite (N)	2016/10/01	NC		%	20
			Dissolved Nitrate (N)	2016/10/01	0.73		%	20
8417669	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/09/30		97	%	80 - 120
			Dissolved Boron (B)	2016/09/30		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/30		99	%	80 - 120
			Dissolved Iron (Fe)	2016/09/30		99	%	80 - 120
			Dissolved Lithium (Li)	2016/09/30		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/30		98	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/30		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/30		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/30		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/30		97	%	80 - 120
			Dissolved Sodium (Na)	2016/09/30		96	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/30		97	%	80 - 120
8417669	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/09/30		99	%	80 - 120
			Dissolved Boron (B)	2016/09/30		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/30		104	%	80 - 120
			Dissolved Iron (Fe)	2016/09/30		101	%	80 - 120
			Dissolved Lithium (Li)	2016/09/30		99	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/30		99	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/30		102	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/30		98	%	80 - 120
			Dissolved Potassium (K)	2016/09/30		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/30		98	%	80 - 120
			Dissolved Sodium (Na)	2016/09/30		96	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/30		99	%	80 - 120
8417669	JHC	Method Blank	Dissolved Barium (Ba)	2016/09/30	<0.010		mg/L	
			Dissolved Boron (B)	2016/09/30	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/09/30	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/30	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/09/30	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/09/30	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/30	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/09/30	<0.10		mg/L	
			Dissolved Potassium (K)	2016/09/30	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/09/30	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/09/30	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/09/30	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/09/30	<0.20		mg/L	
8417669	JHC	RPD	Dissolved Calcium (Ca)	2016/09/30	1.0		%	20
			Dissolved Iron (Fe)	2016/09/30	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/30	0.94		%	20
			Dissolved Manganese (Mn)	2016/09/30	NC		%	20
			Dissolved Potassium (K)	2016/09/30	NC		%	20
			Dissolved Sodium (Na)	2016/09/30	0.12		%	20
8417670	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120

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8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	3.2		%	20
8417688	MB5	Matrix Spike [PQ3528-01]	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417688	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		97	%	80 - 120
8417688	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417688	MB5	RPD [PQ3528-01]	Dissolved Ammonia (N)	2016/09/30	1.3		%	20
8417829	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/01		112	%	80 - 120
			Dissolved Boron (B)	2016/10/01		104	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		111	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		114	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		106	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		105	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		118	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		115	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		111	%	80 - 120
8417829	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/01		105	%	80 - 120
			Dissolved Boron (B)	2016/10/01		97	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		106	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		107	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		103	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		107	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		100	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		109	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		105	%	80 - 120
8417829	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/01	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/01	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/01	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/01	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/01	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/01	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/01	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/01	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/01	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/01	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/01	0.50, RDL=0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/01	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/01	<0.20		mg/L	
8417829	JHC	RPD	Dissolved Barium (Ba)	2016/10/01	0.047		%	20
			Dissolved Boron (B)	2016/10/01	0.55		%	20
			Dissolved Calcium (Ca)	2016/10/01	0.15		%	20
			Dissolved Iron (Fe)	2016/10/01	1.3		%	20
			Dissolved Lithium (Li)	2016/10/01	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/01	0.13		%	20
			Dissolved Manganese (Mn)	2016/10/01	0.044		%	20
			Dissolved Phosphorus (P)	2016/10/01	NC		%	20

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			Dissolved Potassium (K)	2016/10/01	0.21		%	20
			Dissolved Silicon (Si)	2016/10/01	0.18		%	20
			Dissolved Sodium (Na)	2016/10/01	0.084		%	20
			Dissolved Strontium (Sr)	2016/10/01	0.045		%	20
			Dissolved Sulphur (S)	2016/10/01	0.25		%	20
8418321	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/01		109	%	80 - 120
8418321	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		97	%	80 - 120
8418321	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418321	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/01	NC		%	20
8418324	MUK	Matrix Spike [PQ3528-01]	Dissolved Organic Carbon (C)	2016/10/01		103	%	80 - 120
8418324	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		93	%	80 - 120
8418324	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418324	MUK	RPD [PQ3528-01]	Dissolved Organic Carbon (C)	2016/10/01	5.3		%	20
8418959	MB5	Matrix Spike	Dissolved Phosphorus (P)	2016/10/04		97	%	80 - 120
8418959	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/04		100	%	N/A
8418959	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/04		97	%	80 - 120
8418959	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/04	0.0052, RDL=0.0030		mg/L	
8418959	MB5	RPD	Dissolved Phosphorus (P)	2016/10/04	NC		%	20
8419031	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		105	%	80 - 120
8419031	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		95	%	80 - 120
8419031	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		106	%	80 - 120
8419031	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419031	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	NC		%	20
8419036	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		106	%	80 - 120
8419036	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		99	%	80 - 120
8419036	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		99	%	80 - 120
8419036	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419036	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	NC		%	20
8419564	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/03		102	%	80 - 120
8419564	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/03		108	%	80 - 120
8419564	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/03	2.0, RDL=1.0		mg/L	
8419564	KP9	RPD	Dissolved Chloride (Cl)	2016/10/03	NC		%	20
8419569	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/03		130 (1)	%	80 - 120
8419569	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/03		106	%	80 - 120
8419569	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/03	<1.0		mg/L	
8419569	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/03	NC		%	20
8419725	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/03		93	%	80 - 120
8419725	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/03		91	%	80 - 120
8419725	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/03	<0.0020		ug/L	
8419725	RK3	RPD	Dissolved Mercury (Hg)	2016/10/03	NC		%	20
8419734	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/03		101	%	80 - 120
8419734	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/03		109	%	80 - 120
8419734	RK3	Method Blank	Total Mercury (Hg)	2016/10/03	<0.0020		ug/L	
8419734	RK3	RPD	Total Mercury (Hg)	2016/10/03	NC		%	20
8419977	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/04		120	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		100	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		102	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		106	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		99	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		97	%	80 - 120

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			Dissolved Cobalt (Co)	2016/10/04		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		92	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		99	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		102	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		99	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		94	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		101	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		112	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		99	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		108	%	80 - 120
8419977	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/04		114	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		99	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		101	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		98	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		101	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		100	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		99	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		97	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		98	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		98	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		104	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		97	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		93	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		102	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		110	%	80 - 120
8419977	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/04	0.0031, RDL=0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/04	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/04	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/04	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/04	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/04	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/04	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/04	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/04	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/04	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/04	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/04	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/04	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/04	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/04	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/04	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/04	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/04	<0.0010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Zinc (Zn)	2016/10/04	0.0030, RDL=0.0030		mg/L	
8419977	PC5	RPD	Dissolved Aluminum (Al)	2016/10/04	NC		%	20
			Dissolved Chromium (Cr)	2016/10/04	NC		%	20
			Dissolved Copper (Cu)	2016/10/04	NC		%	20
			Dissolved Lead (Pb)	2016/10/04	NC		%	20
8421839	RSA	Matrix Spike [PQ3528-07]	1,4-Difluorobenzene (sur.)	2016/10/07		107	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/07		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/07		115	%	70 - 130
			Benzene	2016/10/07		91	%	70 - 130
			Toluene	2016/10/07		94	%	70 - 130
			Ethylbenzene	2016/10/07		99	%	70 - 130
			m & p-Xylene	2016/10/07		98	%	70 - 130
			o-Xylene	2016/10/07		99	%	70 - 130
			F1 (C6-C10)	2016/10/07		81	%	70 - 130
8421839	RSA	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/06		106	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/06		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/06		101	%	70 - 130
			Benzene	2016/10/06		91	%	70 - 130
			Toluene	2016/10/06		94	%	70 - 130
			Ethylbenzene	2016/10/06		99	%	70 - 130
			m & p-Xylene	2016/10/06		98	%	70 - 130
			o-Xylene	2016/10/06		98	%	70 - 130
			F1 (C6-C10)	2016/10/06		96	%	70 - 130
8421839	RSA	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/06		114	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/06		105	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/06		105	%	70 - 130
			Benzene	2016/10/06	<0.00040		mg/L	
			Toluene	2016/10/06	<0.00040		mg/L	
			Ethylbenzene	2016/10/06	<0.00040		mg/L	
			m & p-Xylene	2016/10/06	<0.00080		mg/L	
			o-Xylene	2016/10/06	<0.00040		mg/L	
			Xylenes (Total)	2016/10/06	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/06	<0.10		mg/L	
			F1 (C6-C10)	2016/10/06	<0.10		mg/L	
8421839	RSA	RPD [PQ3527-07]	Benzene	2016/10/06	NC		%	40
			Toluene	2016/10/06	NC		%	40
			Ethylbenzene	2016/10/06	NC		%	40
			m & p-Xylene	2016/10/06	NC		%	40
			o-Xylene	2016/10/06	NC		%	40
			Xylenes (Total)	2016/10/06	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/06	NC		%	40

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/06	NC		%	40

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Janet Gao, B.Sc., QP, Supervisor, Organics

Lisa Thum, C.E.T., QP, Manager, Inorganics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam
A Bureau Veritas Group Company

Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD M 031857

Page 1 of 1

Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd	Company:	Quotation #:	☑ 5 - 7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112 St, Edmonton, AB, T5K 2L6	Address:	Project #: 110773396	Rush TAT (Surcharges will be applied)
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Email: Dylan.King@stantec.com	Email:	Site #:	Date Required:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D. Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	11	11	14
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Analysis Requested

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	Phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-21-11		2016/09/29	9:52		12		✓		✓	✓	✓		14	15	15	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-23-36		↓	16:56		13		✓		✓	✓	✓		10	10	9	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3	MW16-23-19		↓	17:32		13		✓		✓	✓	✓		9	9	16	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4																										
5																										
6																										
7																										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

☑ AT1/CCME
☑ Drinking Water
☐ Saskatchewan
☐ D50 (Drilling Waste)
☐ Other:

Special Instructions

Due to low sample volume please take DOC from routine Bottle for MW16-21-11

Due to turbidity please filter and preserve dissolved metals, dissolved mercury and DOC for MW16-23-36 submitted same day as sampled

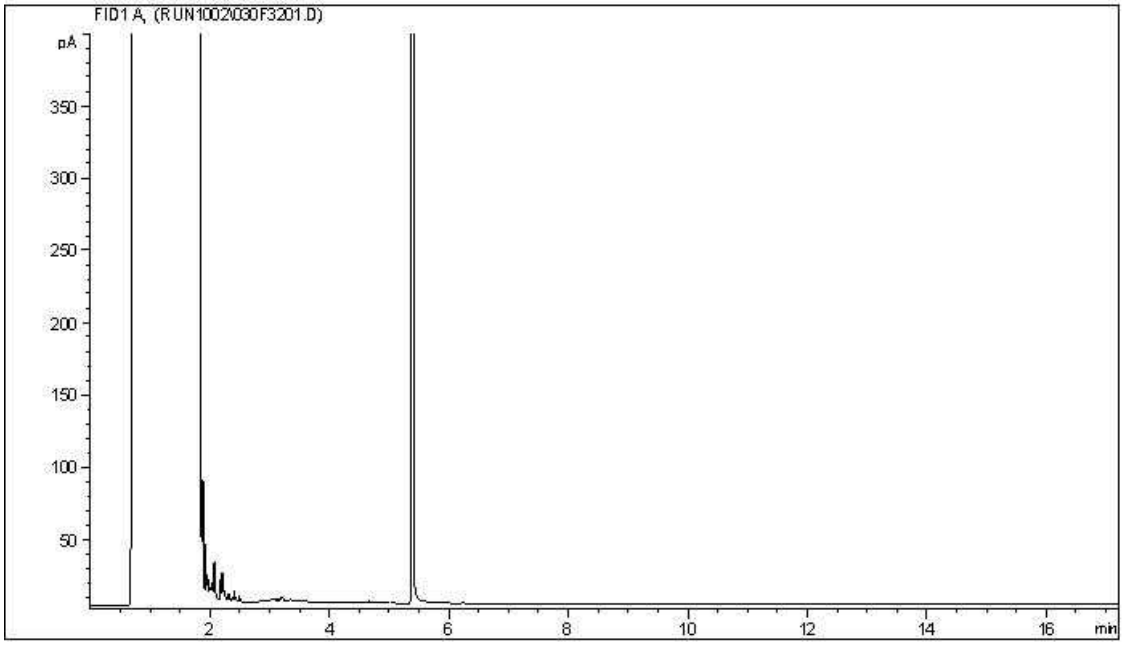
Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/29	19:29	Julamayor ARDRIN VILLAMAYOR	2016/09/29	19:30

29-Sep-16 19:30
Wendy Sears
B685593
AV2 INS-0160

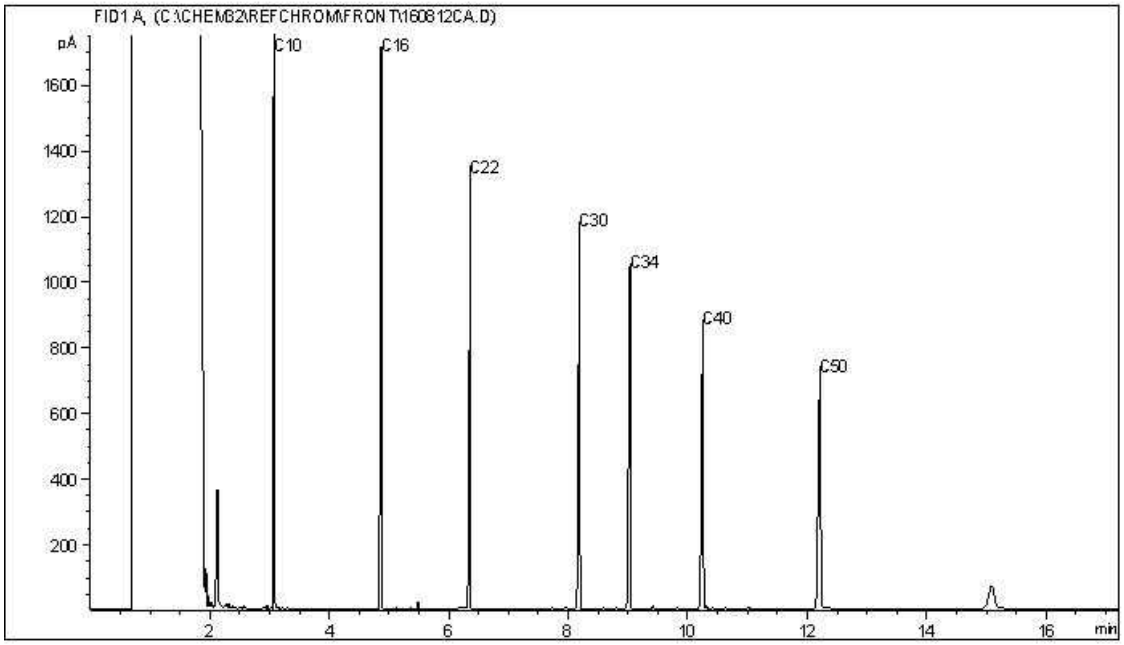
AB FCD-00331/6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



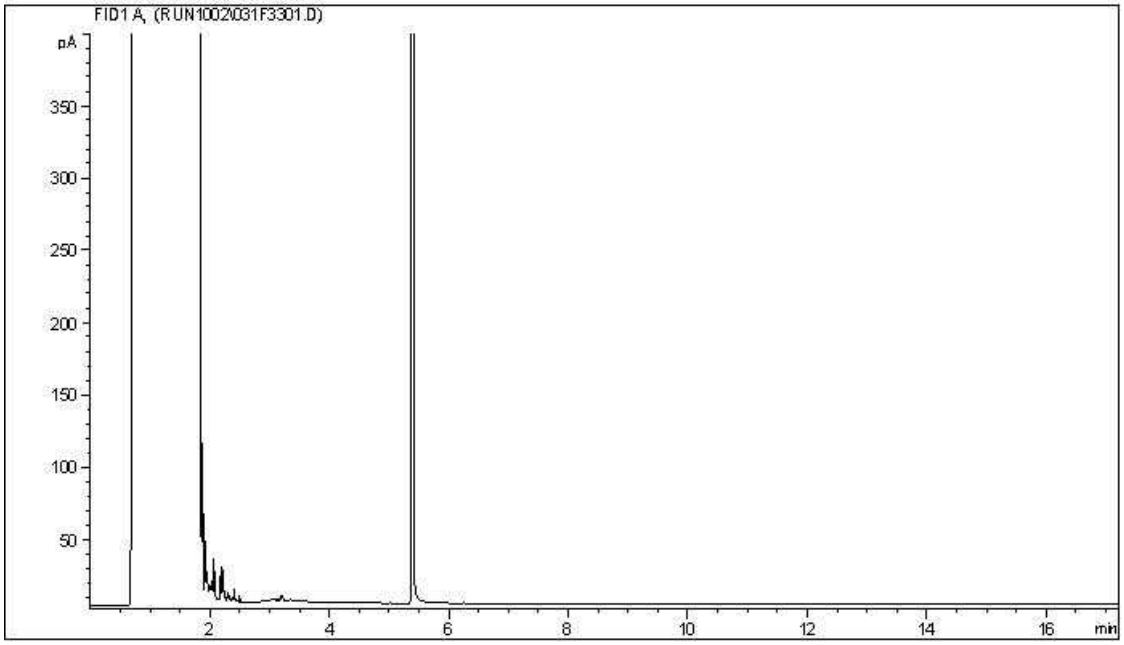
TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

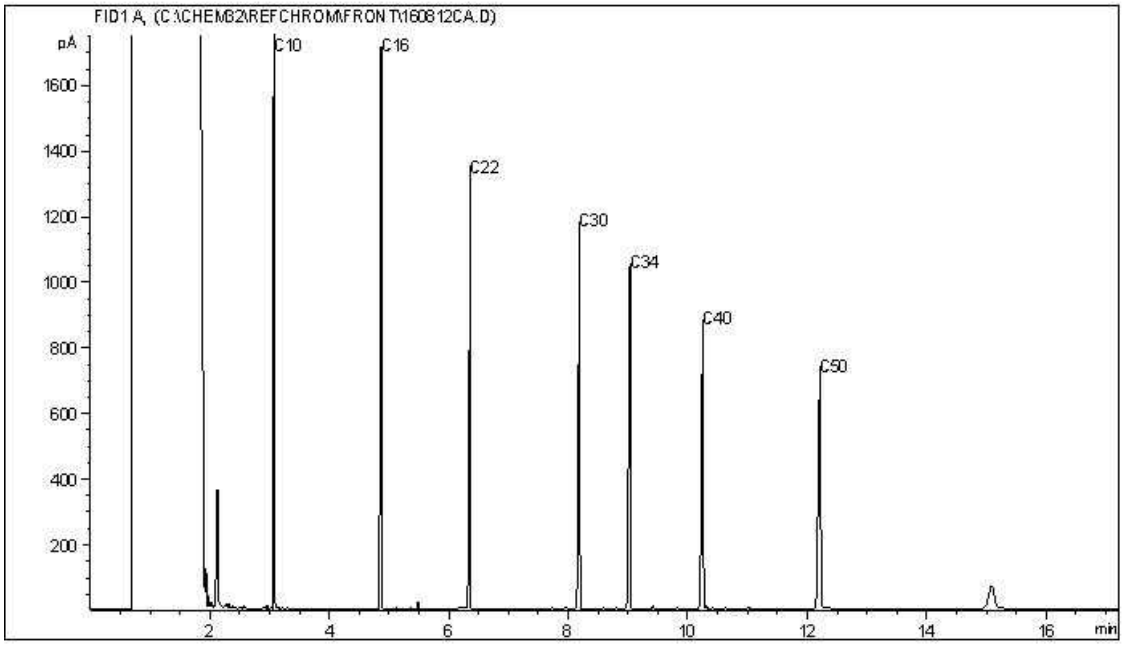
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
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Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

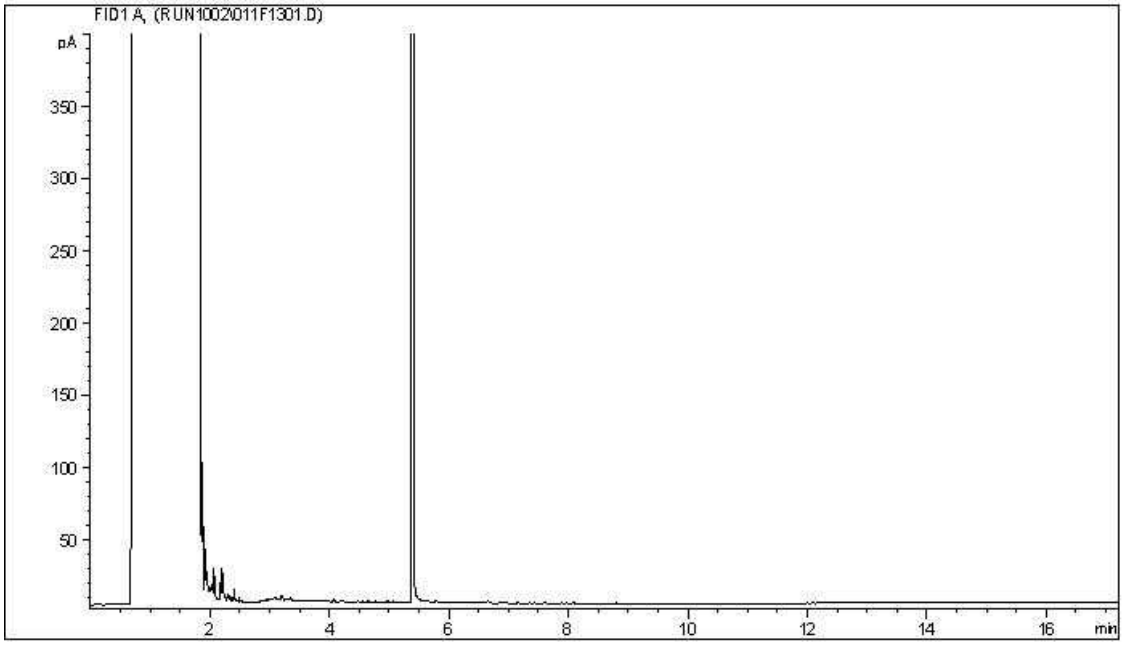
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685593
Report Date: 2016/10/07
Maxxam Sample: PQ3529

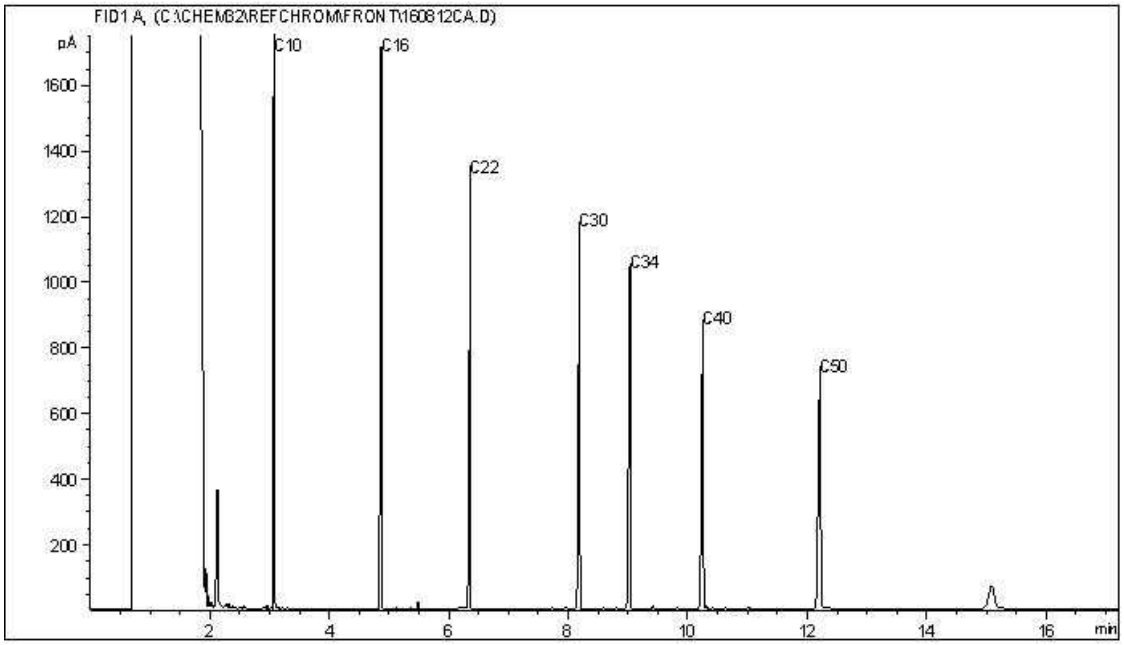
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-23-14

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

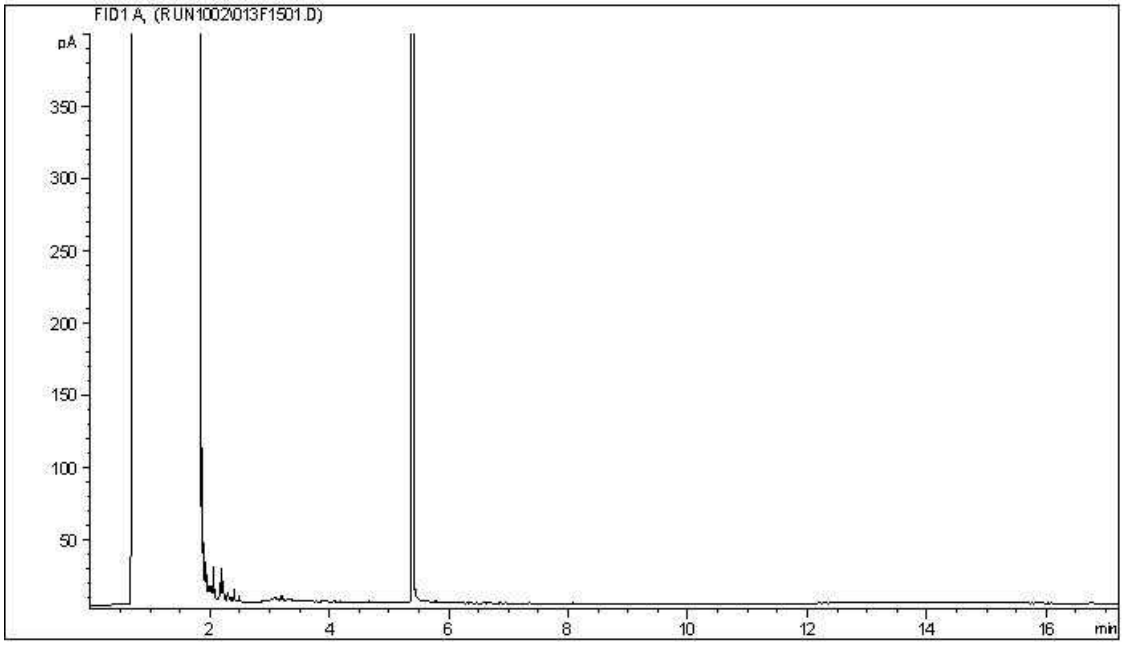
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685593
Report Date: 2016/10/07
Maxxam Sample: PQ3529 Lab-Dup

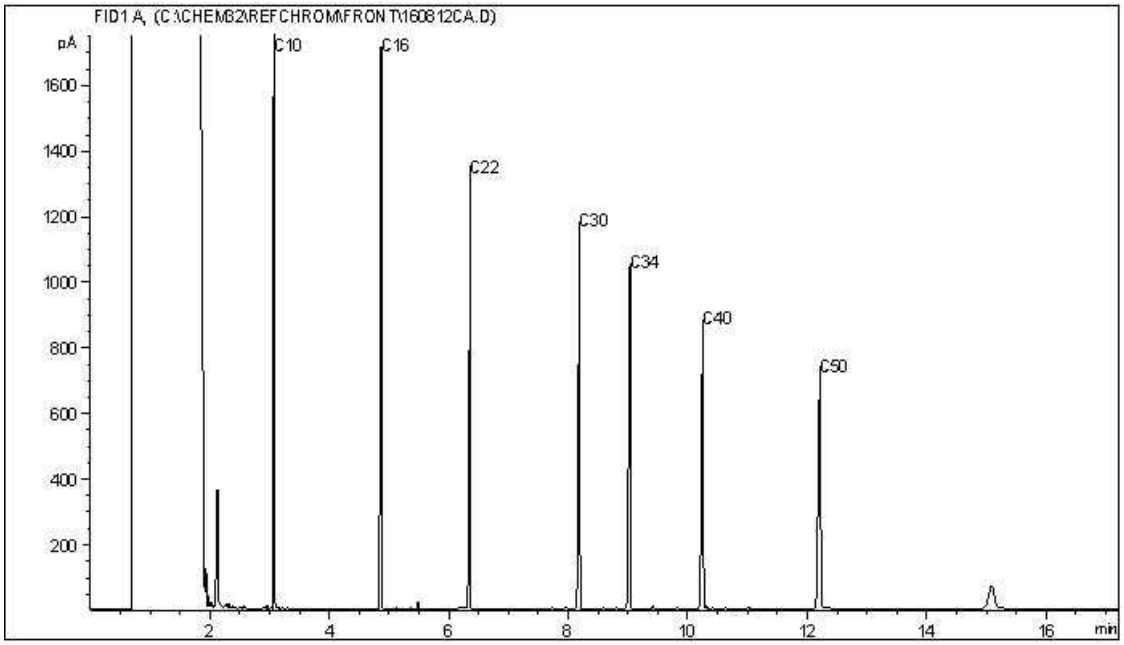
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-23-14

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031906

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/11
Report #: R2279234
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686123
Received: 2016/09/30, 15:57

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	4	N/A	2016/10/03	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	4	N/A	2016/10/08	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	3	N/A	2016/10/06	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry	1	N/A	2016/10/07	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	4	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	4	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/10/05	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	3	N/A	2016/10/05	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	4	N/A	2016/10/03	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	4	2016/10/03	2016/10/04	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Hardness	3	N/A	2016/10/08	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	3	2016/10/07	2016/10/07	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/10/04	2016/10/04	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	4	2016/10/04	2016/10/04	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	3	N/A	2016/10/07	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/05	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	3	N/A	2016/10/04	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/04	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	4	N/A	2016/10/01	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Sum of cations, anions	3	N/A	2016/10/08	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	3	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	4	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	4	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	4	N/A	2016/10/03	AB SOP-00023	SM 22 4110 B m
pH @25°C	4	N/A	2016/10/03	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	4	N/A	2016/10/03	AB SOP-00025	SM 22 4500-P A,F m

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031906

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/11
Report #: R2279234
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686123
Received: 2016/09/30, 15:57

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sulphate by Automated Colourimetry	3	N/A	2016/10/06	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry	1	N/A	2016/10/07	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	4	2016/09/30	2016/10/02	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	1	N/A	2016/10/07	AB WI-00065	Auto Calc
Total Dissolved Solids (Calculated)	3	N/A	2016/10/08	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	4	2016/10/04	2016/10/05	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/10/05	2016/10/05	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	3	2016/10/03	2016/10/04	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PQ7066	PQ7066	PQ7067	PQ7068	PQ7069		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22	2016/09/30 11:21	2016/09/30 14:02	2016/09/30 13:01		
COC Number		M031906	M031906	M031906	M031906	M031906		
	UNITS	MW16-9-6	MW16-9-6 Lab-Dup	MW16-25-9	MW16-11-15	MW16-2-6	RDL	QC Batch
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	0.47	0.10	8419208
Volatiles								
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00044	0.00040	8424673
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8424673
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8424673
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8424673
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8424673
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8424673
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8424673
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8424673
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	111	111	111	112	111	N/A	8424673
4-Bromofluorobenzene (sur.)	%	104	105	104	105	105	N/A	8424673
D4-1,2-Dichloroethane (sur.)	%	106	107	107	108	108	N/A	8424673
O-TERPHENYL (sur.)	%	94	N/A	91	94	90	N/A	8419208

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7066	PQ7066			PQ7067		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22			2016/09/30 11:21		
COC Number		M031906	M031906			M031906		
	UNITS	MW16-9-6	MW16-9-6 Lab-Dup	RDL	QC Batch	MW16-25-9	RDL	QC Batch
Calculated Parameters								
Anion Sum	meq/L	21	N/A	N/A	8417613	13	N/A	8418022
Cation Sum	meq/L	22	N/A	N/A	8417613	14	N/A	8418022
Hardness (CaCO3)	mg/L	930	N/A	0.50	8418724	590	0.50	8418724
Ion Balance	N/A	1.1	N/A	0.010	8417612	1.1	0.010	8418021
Dissolved Nitrate (NO3)	mg/L	0.065	N/A	0.044	8418013	0.064	0.044	8418013
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8418014	<0.020	0.020	8418014
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8418013	<0.033	0.033	8418013
Calculated Total Dissolved Solids	mg/L	1200	N/A	10	8417617	680	10	8418023
Misc. Inorganics								
Conductivity	uS/cm	1700	N/A	1.0	8419207	1100	1.0	8419207
pH	pH	7.88	N/A	N/A	8419206	8.11	N/A	8419206
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8419203	<0.50	0.50	8419203
Alkalinity (Total as CaCO3)	mg/L	510	N/A	0.50	8419203	470	0.50	8419203
Bicarbonate (HCO3)	mg/L	630	N/A	0.50	8419203	580	0.50	8419203
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8419203	<0.50	0.50	8419203
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8419203	<0.50	0.50	8419203
Dissolved Sulphate (SO4)	mg/L	490 (1)	N/A	5.0	8425289	150	1.0	8425254
Dissolved Chloride (Cl)	mg/L	1.6	N/A	1.0	8425265	8.2	1.0	8425251
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	0.010	8419271	<0.010	0.010	8419271
Dissolved Nitrate (N)	mg/L	0.015	0.016	0.010	8419271	0.015	0.010	8419271
Elements								
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	0.0030	8419986	0.028	0.0030	8419986
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	0.00060	8419986	<0.00060	0.00060	8419986
Dissolved Arsenic (As)	mg/L	0.00093	N/A	0.00020	8419986	0.00078	0.00020	8419986
Dissolved Barium (Ba)	mg/L	0.039	N/A	0.010	8424941	0.053	0.010	8424941
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Boron (B)	mg/L	0.14	N/A	0.020	8424941	0.099	0.020	8424941

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7066	PQ7066			PQ7067		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22			2016/09/30 11:21		
COC Number		M031906	M031906			M031906		
	UNITS	MW16-9-6	MW16-9-6 Lab-Dup	RDL	QC Batch	MW16-25-9	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.000073	N/A	0.000020	8419986	0.000065	0.000020	8419986
Dissolved Calcium (Ca)	mg/L	220	N/A	0.30	8424941	140	0.30	8424941
Dissolved Chromium (Cr)	mg/L	0.0043	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Cobalt (Co)	mg/L	0.0037	N/A	0.00030	8419986	0.0020	0.00030	8419986
Dissolved Copper (Cu)	mg/L	0.00064	N/A	0.00020	8419986	0.0011	0.00020	8419986
Dissolved Iron (Fe)	mg/L	0.13	N/A	0.060	8424941	0.16	0.060	8424941
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8419986	<0.00020	0.00020	8419986
Dissolved Lithium (Li)	mg/L	0.030	N/A	0.020	8424941	0.034	0.020	8424941
Dissolved Magnesium (Mg)	mg/L	94	N/A	0.20	8424941	59	0.20	8424941
Dissolved Manganese (Mn)	mg/L	0.93	N/A	0.0040	8424941	0.23	0.0040	8424941
Dissolved Molybdenum (Mo)	mg/L	0.00082	N/A	0.00020	8419986	0.0036	0.00020	8419986
Dissolved Nickel (Ni)	mg/L	0.0071	N/A	0.00050	8419986	0.0067	0.00050	8419986
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8424941	<0.10	0.10	8424941
Dissolved Potassium (K)	mg/L	5.6	N/A	0.30	8424941	6.6	0.30	8424941
Dissolved Selenium (Se)	mg/L	<0.00020	N/A	0.00020	8419986	0.0014	0.00020	8419986
Dissolved Silicon (Si)	mg/L	5.5	N/A	0.10	8424941	7.0	0.10	8424941
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8419986	<0.00010	0.00010	8419986
Dissolved Sodium (Na)	mg/L	71	N/A	0.50	8424941	34	0.50	8424941
Dissolved Strontium (Sr)	mg/L	1.4	N/A	0.020	8424941	0.74	0.020	8424941
Dissolved Sulphur (S)	mg/L	180	N/A	0.20	8424941	49	0.20	8424941
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8419986	<0.00020	0.00020	8419986
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Uranium (U)	mg/L	0.0086	N/A	0.00010	8419986	0.014	0.00010	8419986
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8419986	0.0011	0.0010	8419986
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	0.0030	8419986	<0.0030	0.0030	8419986

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7068	PQ7068		
Sampling Date		2016/09/30 14:02	2016/09/30 14:02		
COC Number		M031906	M031906		
	UNITS	MW16-11-15	MW16-11-15 Lab-Dup	RDL	QC Batch
Calculated Parameters					
Anion Sum	meq/L	39	N/A	N/A	8418022
Cation Sum	meq/L	38	N/A	N/A	8418022
Hardness (CaCO3)	mg/L	1200	N/A	0.50	8418724
Ion Balance	N/A	0.98	N/A	0.010	8418021
Dissolved Nitrate (NO3)	mg/L	<0.044	N/A	0.044	8418013
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8418014
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8418013
Calculated Total Dissolved Solids	mg/L	2400	N/A	10	8418023
Misc. Inorganics					
Conductivity	uS/cm	3100	3100	1.0	8419207
pH	pH	7.99	7.98	N/A	8419206
Anions					
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	0.50	8419203
Alkalinity (Total as CaCO3)	mg/L	410	410	0.50	8419203
Bicarbonate (HCO3)	mg/L	500	500	0.50	8419203
Carbonate (CO3)	mg/L	<0.50	<0.50	0.50	8419203
Hydroxide (OH)	mg/L	<0.50	<0.50	0.50	8419203
Dissolved Sulphate (SO4)	mg/L	1500 (1)	N/A	10	8425254
Dissolved Chloride (Cl)	mg/L	1.7	N/A	1.0	8425251
Nutrients					
Dissolved Nitrite (N)	mg/L	<0.010	N/A	0.010	8419271
Dissolved Nitrate (N)	mg/L	<0.010	N/A	0.010	8419271
Elements					
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	0.0030	8419986
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	0.00060	8419986
Dissolved Arsenic (As)	mg/L	0.0012	N/A	0.00020	8419986
Dissolved Barium (Ba)	mg/L	0.016	N/A	0.010	8424941
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8419986

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7068	PQ7068		
Sampling Date		2016/09/30 14:02	2016/09/30 14:02		
COC Number		M031906	M031906		
	UNITS	MW16-11-15	MW16-11-15 Lab-Dup	RDL	QC Batch
Dissolved Boron (B)	mg/L	0.10	N/A	0.020	8424941
Dissolved Cadmium (Cd)	mg/L	0.000043	N/A	0.000020	8419986
Dissolved Calcium (Ca)	mg/L	290	N/A	0.30	8424941
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Cobalt (Co)	mg/L	0.0016	N/A	0.00030	8419986
Dissolved Copper (Cu)	mg/L	0.00029	N/A	0.00020	8419986
Dissolved Iron (Fe)	mg/L	0.37	N/A	0.060	8424941
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8419986
Dissolved Lithium (Li)	mg/L	0.050	N/A	0.020	8424941
Dissolved Magnesium (Mg)	mg/L	110	N/A	0.20	8424941
Dissolved Manganese (Mn)	mg/L	0.77	N/A	0.0040	8424941
Dissolved Molybdenum (Mo)	mg/L	0.0015	N/A	0.00020	8419986
Dissolved Nickel (Ni)	mg/L	0.0027	N/A	0.00050	8419986
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8424941
Dissolved Potassium (K)	mg/L	6.0	N/A	0.30	8424941
Dissolved Selenium (Se)	mg/L	<0.00020	N/A	0.00020	8419986
Dissolved Silicon (Si)	mg/L	4.8	N/A	0.10	8424941
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8419986
Dissolved Sodium (Na)	mg/L	320	N/A	0.50	8424941
Dissolved Strontium (Sr)	mg/L	2.6	N/A	0.020	8424941
Dissolved Sulphur (S)	mg/L	480	N/A	0.20	8424941
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8419986
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Uranium (U)	mg/L	0.0071	N/A	0.00010	8419986
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Zinc (Zn)	mg/L	0.0053	N/A	0.0030	8419986

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7069		
Sampling Date		2016/09/30 13:01		
COC Number		M031906		
	UNITS	MW16-2-6	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	83	N/A	8418022
Cation Sum	meq/L	83	N/A	8418022
Hardness (CaCO3)	mg/L	2600	0.50	8418020
Ion Balance	N/A	1.0	0.010	8418021
Dissolved Nitrate (NO3)	mg/L	<0.22	0.22	8418013
Nitrate plus Nitrite (N)	mg/L	0.024	0.020	8418014
Dissolved Nitrite (NO2)	mg/L	0.078	0.033	8418013
Calculated Total Dissolved Solids	mg/L	5300	10	8418023
Misc. Inorganics				
Conductivity	uS/cm	5900	1.0	8419207
pH	pH	7.95	N/A	8419206
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8419203
Alkalinity (Total as CaCO3)	mg/L	520	0.50	8419203
Bicarbonate (HCO3)	mg/L	630	0.50	8419203
Carbonate (CO3)	mg/L	<0.50	0.50	8419203
Hydroxide (OH)	mg/L	<0.50	0.50	8419203
Dissolved Sulphate (SO4)	mg/L	3500 (1)	25	8426427
Dissolved Chloride (Cl)	mg/L	6.0	1.0	8426417
Nutrients				
Dissolved Nitrite (N)	mg/L	0.024	0.010	8419271
Dissolved Nitrate (N)	mg/L	<0.050 (2)	0.050	8419271
Lab Filtered Elements				
Dissolved Aluminum (Al)	mg/L	0.016	0.0030	8419977
Dissolved Antimony (Sb)	mg/L	0.00073	0.00060	8419977
Dissolved Arsenic (As)	mg/L	0.0044	0.00020	8419977
Dissolved Barium (Ba)	mg/L	0.018	0.010	8421827
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8419977

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7069		
Sampling Date		2016/09/30 13:01		
COC Number		M031906		
	UNITS	MW16-2-6	RDL	QC Batch
Dissolved Boron (B)	mg/L	0.11	0.020	8421827
Dissolved Cadmium (Cd)	mg/L	0.000092	0.000020	8419977
Dissolved Calcium (Ca)	mg/L	390	0.30	8421827
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8419977
Dissolved Cobalt (Co)	mg/L	0.0060	0.00030	8419977
Dissolved Copper (Cu)	mg/L	0.00084	0.00020	8419977
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8421827
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8419977
Dissolved Lithium (Li)	mg/L	0.11	0.020	8421827
Dissolved Magnesium (Mg)	mg/L	400	0.20	8421827
Dissolved Manganese (Mn)	mg/L	1.5	0.0040	8421827
Dissolved Molybdenum (Mo)	mg/L	0.0071	0.00020	8419977
Dissolved Nickel (Ni)	mg/L	0.016	0.00050	8419977
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8421827
Dissolved Potassium (K)	mg/L	9.4	0.30	8421827
Dissolved Selenium (Se)	mg/L	0.0013	0.00020	8419977
Dissolved Silicon (Si)	mg/L	5.9	0.10	8421827
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8419977
Dissolved Sodium (Na)	mg/L	690 (1)	5.0	8421827
Dissolved Strontium (Sr)	mg/L	4.6	0.020	8421827
Dissolved Sulphur (S)	mg/L	1200 (1)	2.0	8421827
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8419977
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8419977
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8419977
Dissolved Uranium (U)	mg/L	0.040	0.00010	8419977
Dissolved Vanadium (V)	mg/L	0.0016	0.0010	8419977
Dissolved Zinc (Zn)	mg/L	0.016	0.0030	8419977

RDL = Reportable Detection Limit

(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ7066	PQ7066		PQ7067	PQ7067		PQ7068		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22		2016/09/30 11:21	2016/09/30 11:21		2016/09/30 14:02		
COC Number		M031906	M031906		M031906	M031906		M031906		
	UNITS	MW16-9-6	MW16-9-6 Lab-Dup	RDL	MW16-25-9	MW16-25-9 Lab-Dup	RDL	MW16-11-15	RDL	QC Batch
Misc. Inorganics										
Dissolved Organic Carbon (C)	mg/L	4.7	N/A	0.50	5.6	N/A	0.50	3.1	0.50	8422700
Microbiological Param.										
E.Coli DST	mpn/100mL	<1.0	N/A	1.0	<10 (1)	N/A	10	<100 (1)	100	8416950
Fecal Coliforms	MPN/100mL	<1.0	N/A	1.0	<10 (1)	N/A	10	<100 (1)	100	8416953
Heterotrophic Plate Count	CFU/mL	1100	1100	1.0	7900 (2)	8300	10	23000 (3)	100	8416947
Total Coliforms DST	mpn/100mL	390	N/A	1.0	>2400 (1)	N/A	10	100 (1)	100	8416950
Nutrients										
Dissolved Ammonia (N)	mg/L	0.16	0.16	0.050	0.12	N/A	0.050	0.49	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	0.20	N/A	0.050	0.54 (1)	N/A	0.25	3.7 (1)	0.25	8421122
Orthophosphate (P)	mg/L	0.0036	N/A	0.0030	0.0086	N/A	0.0030	<0.0030	0.0030	8419663
Dissolved Phosphorus (P)	mg/L	0.0059	0.0062	0.0030	0.016	N/A	0.0030	0.0033	0.0030	8419539

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
Spreader colonies were present in the Petri dish. Presence of spreader colonies may obscure other colonies, possibly biasing results.

(3) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ7068	PQ7069	PQ7069		
Sampling Date		2016/09/30 14:02	2016/09/30 13:01	2016/09/30 13:01		
COC Number		M031906	M031906	M031906		
	UNITS	MW16-11-15 Lab-Dup	MW16-2-6	MW16-2-6 Lab-Dup	RDL	QC Batch
Lab Filtered Inorganics						
Dissolved Organic Carbon (C)	mg/L	N/A	6.2	6.5	0.50	8422695
Microbiological Param.						
E.Coli DST	mpn/100mL	N/A	<100 (1)	N/A	100	8416950
Fecal Coliforms	MPN/100mL	N/A	<100 (1)	N/A	100	8416953
Heterotrophic Plate Count	CFU/mL	24000	49000 (2)	48000	100	8416947
Total Coliforms DST	mpn/100mL	N/A	<100 (1)	N/A	100	8416950
Nutrients						
Total Kjeldahl Nitrogen	mg/L	N/A	5.1 (1)	N/A	0.25	8421122
Orthophosphate (P)	mg/L	N/A	0.0041	N/A	0.0030	8419663
Lab Filtered Nutrients						
Dissolved Ammonia (N)	mg/L	N/A	0.27	0.24	0.050	8423178
Dissolved Phosphorus (P)	mg/L	N/A	0.0094	0.0090	0.0030	8422263

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

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Maxxam Job #: B686123
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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PQ7066		PQ7067		PQ7068	PQ7069		
Sampling Date		2016/09/30 12:22		2016/09/30 11:21		2016/09/30 14:02	2016/09/30 13:01		
COC Number		M031906		M031906		M031906	M031906		
	UNITS	MW16-9-6	RDL	MW16-25-9	RDL	MW16-11-15	MW16-2-6	RDL	QC Batch
Low Level Elements									
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	0.0035	0.0020	0.0036	N/A	0.0020	8426284
Total Mercury (Hg)	ug/L	<0.020 (1)	0.020	<2.0 (1)	2.0	<6.0 (1)	<6.0 (1)	6.0	8421406
Lab Filtered Elements-Low									
Dissolved Mercury (Hg)	ug/L	N/A	N/A	N/A	N/A	N/A	<0.0020	0.0020	8421467

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	11.3°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8416947	GK1	Method Blank	Heterotrophic Plate Count	2016/10/02	<1.0		CFU/mL	
8416947	GK1	RPD	Heterotrophic Plate Count	2016/10/02	3.5		%	N/A
			Heterotrophic Plate Count	2016/10/02	6.8		%	N/A
			Heterotrophic Plate Count	2016/10/02	0.60		%	N/A
			Heterotrophic Plate Count	2016/10/02	NC		%	N/A
8416947	GK1	RPD [PQ7066-09]	Heterotrophic Plate Count	2016/10/02	2.2		%	N/A
8416947	GK1	RPD [PQ7067-09]	Heterotrophic Plate Count	2016/10/02	5.4		%	N/A
8416947	GK1	RPD [PQ7068-09]	Heterotrophic Plate Count	2016/10/02	4.3		%	N/A
8416947	GK1	RPD [PQ7069-09]	Heterotrophic Plate Count	2016/10/02	1.5		%	N/A
8416950	GK1	Method Blank	E.Coli DST	2016/10/01	<1.0		mpn/100	
			Total Coliforms DST	2016/10/01	<1.0		mpn/100	
8416950	GK1	RPD	Total Coliforms DST	2016/10/01	NC		%	N/A
8416953	GK1	Method Blank	Fecal Coliforms	2016/10/01	<1.0		MPN/10	
8416953	GK1	RPD	Fecal Coliforms	2016/10/01	NC		%	N/A
8419203	LQ1	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/03		100	%	80 - 120
8419203	LQ1	Method Blank	Alkalinity (PP as CaCO3)	2016/10/03	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/03	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/03	<0.50		mg/L	
			Carbonate (CO3)	2016/10/03	<0.50		mg/L	
			Hydroxide (OH)	2016/10/03	<0.50		mg/L	
8419203	LQ1	RPD [PQ7068-01]	Alkalinity (PP as CaCO3)	2016/10/03	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/03	0.49		%	20
			Bicarbonate (HCO3)	2016/10/03	0.49		%	20
			Carbonate (CO3)	2016/10/03	NC		%	20
			Hydroxide (OH)	2016/10/03	NC		%	20
8419206	LQ1	Spiked Blank	pH	2016/10/03		100	%	97 - 103
8419206	LQ1	RPD [PQ7068-01]	pH	2016/10/03	0.054		%	N/A
8419207	LQ1	Spiked Blank	Conductivity	2016/10/03		102	%	90 - 110
8419207	LQ1	Method Blank	Conductivity	2016/10/03	<1.0		uS/cm	
8419207	LQ1	RPD [PQ7068-01]	Conductivity	2016/10/03	0.33		%	20
8419208	LSH	Matrix Spike	O-TERPHENYL (sur.)	2016/10/03		101	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/03		100	%	50 - 130
8419208	LSH	Spiked Blank	O-TERPHENYL (sur.)	2016/10/03		97	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/03		96	%	70 - 130
8419208	LSH	Method Blank	O-TERPHENYL (sur.)	2016/10/03		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/03	<0.10		mg/L	
8419208	LSH	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/03	NC		%	40
8419271	LQ1	Matrix Spike [PQ7066-01]	Dissolved Nitrite (N)	2016/10/03		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/03		103	%	80 - 120
8419271	LQ1	Spiked Blank	Dissolved Nitrite (N)	2016/10/03		101	%	80 - 120
			Dissolved Nitrate (N)	2016/10/03		102	%	80 - 120
8419271	LQ1	Method Blank	Dissolved Nitrite (N)	2016/10/03	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/03	<0.010		mg/L	
8419271	LQ1	RPD [PQ7066-01]	Dissolved Nitrite (N)	2016/10/03	NC		%	20
			Dissolved Nitrate (N)	2016/10/03	NC		%	20
8419539	MB5	Matrix Spike [PQ7066-03]	Dissolved Phosphorus (P)	2016/10/04		97	%	80 - 120
8419539	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/04		99	%	80 - 120
8419539	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/04		102	%	80 - 120
8419539	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/04	<0.0030		mg/L	
8419539	MB5	RPD [PQ7066-03]	Dissolved Phosphorus (P)	2016/10/04	NC		%	20
8419663	MB5	Matrix Spike	Orthophosphate (P)	2016/10/03		96	%	80 - 120
8419663	MB5	Spiked Blank	Orthophosphate (P)	2016/10/03		101	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8419663	MB5	Method Blank	Orthophosphate (P)	2016/10/03	<0.0030		mg/L	
8419663	MB5	RPD	Orthophosphate (P)	2016/10/03	NC		%	20
8419977	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/04		120	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		100	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		102	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		106	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		99	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		97	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		92	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		99	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		102	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		99	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		94	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		101	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		112	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		99	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		108	%	80 - 120
8419977	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/04		114	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		99	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		101	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		98	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		101	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		100	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		99	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		97	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		98	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		98	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		104	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		97	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		93	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		102	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		110	%	80 - 120
8419977	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/04	0.0031, RDL=0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/04	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/04	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/04	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/04	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/04	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/04	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/04	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/04	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/04	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/04	<0.00050		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Selenium (Se)	2016/10/04	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/04	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/04	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/04	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/04	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/04	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/04	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/04	0.0030, RDL=0.0030		mg/L	
8419977	PC5	RPD	Dissolved Aluminum (Al)	2016/10/04	NC		%	20
			Dissolved Chromium (Cr)	2016/10/04	NC		%	20
			Dissolved Copper (Cu)	2016/10/04	NC		%	20
			Dissolved Lead (Pb)	2016/10/04	NC		%	20
8419986	STI	Matrix Spike	Dissolved Aluminum (Al)	2016/10/04		120	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		91	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		104	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		96	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		90	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		89	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		103	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		93	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		105	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		97	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		94	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		90	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		95	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		97	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		86	%	80 - 120
8419986	STI	Spiked Blank	Dissolved Aluminum (Al)	2016/10/04		123 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		94	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		108	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		96	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		97	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		95	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		94	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		101	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		95	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		90	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		96	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		95	%	80 - 120
8419986	STI	Method Blank	Dissolved Aluminum (Al)	2016/10/04	<0.0030		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Antimony (Sb)	2016/10/04	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/04	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/04	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/04	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/04	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/04	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/04	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/04	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/04	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/04	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/04	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/04	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/04	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/04	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/04	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/04	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/04	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/04	<0.0030		mg/L	
8419986	STI	RPD	Dissolved Aluminum (Al)	2016/10/04	NC		%	20
			Dissolved Antimony (Sb)	2016/10/04	NC		%	20
			Dissolved Arsenic (As)	2016/10/04	NC		%	20
			Dissolved Beryllium (Be)	2016/10/04	NC		%	20
			Dissolved Chromium (Cr)	2016/10/04	NC		%	20
			Dissolved Cobalt (Co)	2016/10/04	NC		%	20
			Dissolved Copper (Cu)	2016/10/04	NC		%	20
			Dissolved Lead (Pb)	2016/10/04	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/04	0.86		%	20
			Dissolved Nickel (Ni)	2016/10/04	NC		%	20
			Dissolved Selenium (Se)	2016/10/04	1.9		%	20
			Dissolved Silver (Ag)	2016/10/04	NC		%	20
			Dissolved Thallium (Tl)	2016/10/04	NC		%	20
			Dissolved Tin (Sn)	2016/10/04	NC		%	20
			Dissolved Titanium (Ti)	2016/10/04	NC		%	20
			Dissolved Uranium (U)	2016/10/04	1.1		%	20
			Dissolved Vanadium (V)	2016/10/04	NC		%	20
			Dissolved Zinc (Zn)	2016/10/04	NC		%	20
8421122	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/05		NC	%	80 - 120
8421122	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/05		94	%	80 - 120
8421122	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/05		92	%	80 - 120
8421122	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/05	<0.050		mg/L	
8421122	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/05	12		%	20
8421406	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/04		105	%	80 - 120
8421406	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/04		97	%	80 - 120
8421406	RK3	Method Blank	Total Mercury (Hg)	2016/10/04	<0.0020		ug/L	
8421406	RK3	RPD	Total Mercury (Hg)	2016/10/04	NC		%	20
8421467	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/04		105	%	80 - 120
8421467	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/04		104	%	80 - 120
8421467	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/04	<0.0020		ug/L	
8421467	RK3	RPD	Dissolved Mercury (Hg)	2016/10/04	NC		%	20
8421827	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/05		94	%	80 - 120
			Dissolved Boron (B)	2016/10/05		92	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Iron (Fe)	2016/10/05		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		94	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		102	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		98	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		94	%	80 - 120
8421827	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/05		94	%	80 - 120
			Dissolved Boron (B)	2016/10/05		92	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		95	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		101	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		100	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		100	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		97	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		96	%	80 - 120
8421827	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/05	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/05	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/05	<0.20		mg/L	
8421827	JHC	RPD	Dissolved Barium (Ba)	2016/10/05	NC		%	20
			Dissolved Boron (B)	2016/10/05	NC		%	20
			Dissolved Calcium (Ca)	2016/10/05	NC		%	20
			Dissolved Iron (Fe)	2016/10/05	NC		%	20
			Dissolved Lithium (Li)	2016/10/05	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/05	NC		%	20
			Dissolved Manganese (Mn)	2016/10/05	NC		%	20
			Dissolved Phosphorus (P)	2016/10/05	NC		%	20
			Dissolved Potassium (K)	2016/10/05	NC		%	20
			Dissolved Silicon (Si)	2016/10/05	NC		%	20
			Dissolved Sodium (Na)	2016/10/05	NC		%	20
			Dissolved Strontium (Sr)	2016/10/05	NC		%	20
			Dissolved Sulphur (S)	2016/10/05	NC		%	20
8422263	MB5	Matrix Spike [PQ7069-01]	Dissolved Phosphorus (P)	2016/10/05		94	%	80 - 120
8422263	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
8422263	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/05		103	%	80 - 120
8422263	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/05	<0.0030		mg/L	
8422263	MB5	RPD [PQ7069-01]	Dissolved Phosphorus (P)	2016/10/05	NC		%	20

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8422695	MUK	Matrix Spike [PQ7069-01]	Dissolved Organic Carbon (C)	2016/10/05		NC	%	80 - 120
8422695	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/05		104	%	80 - 120
8422695	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/05	<0.50		mg/L	
8422695	MUK	RPD [PQ7069-01]	Dissolved Organic Carbon (C)	2016/10/05	3.6		%	20
8422700	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/05		NC	%	80 - 120
8422700	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/05		95	%	80 - 120
8422700	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/05	<0.50		mg/L	
8422700	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/05	3.0		%	20
8423168	MB5	Matrix Spike [PQ7066-03]	Dissolved Ammonia (N)	2016/10/05		93	%	80 - 120
8423168	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		94	%	80 - 120
8423168	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423168	MB5	RPD [PQ7066-03]	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8423178	MB5	Matrix Spike [PQ7069-01]	Dissolved Ammonia (N)	2016/10/06		83	%	80 - 120
8423178	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		97	%	80 - 120
8423178	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423178	MB5	RPD [PQ7069-01]	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8424673	RSA	Matrix Spike [PQ7067-08]	1,4-Difluorobenzene (sur.)	2016/10/07		103	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/07		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/07		114	%	70 - 130
			Benzene	2016/10/07		89	%	70 - 130
			Toluene	2016/10/07		89	%	70 - 130
			Ethylbenzene	2016/10/07		91	%	70 - 130
			m & p-Xylene	2016/10/07		90	%	70 - 130
			o-Xylene	2016/10/07		91	%	70 - 130
			F1 (C6-C10)	2016/10/07		84	%	70 - 130
8424673	RSA	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/07		104	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/07		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/07		112	%	70 - 130
			Benzene	2016/10/07		88	%	70 - 130
			Toluene	2016/10/07		89	%	70 - 130
			Ethylbenzene	2016/10/07		92	%	70 - 130
			m & p-Xylene	2016/10/07		91	%	70 - 130
			o-Xylene	2016/10/07		91	%	70 - 130
			F1 (C6-C10)	2016/10/07		87	%	70 - 130
8424673	RSA	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/08		112	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		105	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		105	%	70 - 130
			Benzene	2016/10/08	<0.00040		mg/L	
			Toluene	2016/10/08	<0.00040		mg/L	
			Ethylbenzene	2016/10/08	<0.00040		mg/L	
			m & p-Xylene	2016/10/08	<0.00080		mg/L	
			o-Xylene	2016/10/08	<0.00040		mg/L	
			Xylenes (Total)	2016/10/08	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/08	<0.10		mg/L	
			F1 (C6-C10)	2016/10/08	<0.10		mg/L	
8424673	RSA	RPD [PQ7066-08]	Benzene	2016/10/08	NC		%	40
			Toluene	2016/10/08	NC		%	40
			Ethylbenzene	2016/10/08	NC		%	40
			m & p-Xylene	2016/10/08	NC		%	40
			o-Xylene	2016/10/08	NC		%	40
			Xylenes (Total)	2016/10/08	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/08	NC		%	40

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/08	NC		%	40
8424941	MAP	Matrix Spike	Dissolved Barium (Ba)	2016/10/08		99	%	80 - 120
			Dissolved Boron (B)	2016/10/08		95	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		97	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		108	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		NC	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		NC	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		103	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		112	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		NC	%	80 - 120
8424941	MAP	Spiked Blank	Dissolved Barium (Ba)	2016/10/07		95	%	80 - 120
			Dissolved Boron (B)	2016/10/07		90	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/07		104	%	80 - 120
			Dissolved Iron (Fe)	2016/10/07		101	%	80 - 120
			Dissolved Lithium (Li)	2016/10/07		95	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/07		100	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/07		98	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/07		97	%	80 - 120
			Dissolved Potassium (K)	2016/10/07		95	%	80 - 120
			Dissolved Silicon (Si)	2016/10/07		97	%	80 - 120
			Dissolved Sodium (Na)	2016/10/07		97	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/07		96	%	80 - 120
8424941	MAP	Method Blank	Dissolved Barium (Ba)	2016/10/07	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/07	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/07	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/07	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/07	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/07	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/07	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/07	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/07	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/07	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/07	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/07	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/07	<0.20		mg/L	
8424941	MAP	RPD	Dissolved Barium (Ba)	2016/10/07	NC		%	20
			Dissolved Boron (B)	2016/10/07	0.58		%	20
			Dissolved Calcium (Ca)	2016/10/07	0.041		%	20
			Dissolved Iron (Fe)	2016/10/07	2.2		%	20
			Dissolved Lithium (Li)	2016/10/07	1.6		%	20
			Dissolved Magnesium (Mg)	2016/10/07	10		%	20
			Dissolved Manganese (Mn)	2016/10/07	2.5		%	20
			Dissolved Phosphorus (P)	2016/10/07	NC		%	20
			Dissolved Potassium (K)	2016/10/07	0.27		%	20
			Dissolved Silicon (Si)	2016/10/07	0.27		%	20
			Dissolved Sodium (Na)	2016/10/07	11		%	20
			Dissolved Strontium (Sr)	2016/10/07	0.080		%	20
			Dissolved Sulphur (S)	2016/10/07	9.8		%	20
8425251	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/06		NC	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8425251	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/06		107	%	80 - 120
8425251	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/06	<1.0		mg/L	
8425251	KP9	RPD	Dissolved Chloride (Cl)	2016/10/06	0.071		%	20
8425254	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/06		NC	%	80 - 120
8425254	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/06		104	%	80 - 120
8425254	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/06	<1.0		mg/L	
8425254	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/06	0.53		%	20
8425265	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/06		108	%	80 - 120
8425265	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/06		106	%	80 - 120
8425265	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/06	<1.0		mg/L	
8425265	KP9	RPD	Dissolved Chloride (Cl)	2016/10/06	NC		%	20
8425289	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/06		112	%	80 - 120
8425289	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/06		102	%	80 - 120
8425289	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/06	<1.0		mg/L	
8425289	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/06	NC		%	20
8426284	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/07		102	%	80 - 120
8426284	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/07		90	%	80 - 120
8426284	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/07	<0.0020		ug/L	
8426284	RK3	RPD	Dissolved Mercury (Hg)	2016/10/07	NC		%	20
8426417	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/07		NC	%	80 - 120
8426417	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/07		102	%	80 - 120
8426417	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/07	1.0, RDL=1.0		mg/L	
8426417	ZI	RPD	Dissolved Chloride (Cl)	2016/10/07	4.0		%	20
8426427	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/07		NC	%	80 - 120
8426427	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/07		102	%	80 - 120
8426427	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/07	<1.0		mg/L	
8426427	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/07	0.59		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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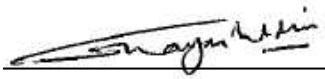
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

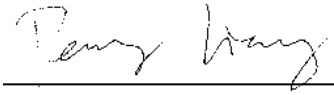
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics



Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1403

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A Bureau Veritas Group Company

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Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD M 031906 Page 1 of 1

Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd.	Company:	Quotation #:	☑ 5 - 7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112 St, Edmonton AB T5K 2L6	Address:	Project #: 160773396	Rush TAT (Surcharges will be applied): ☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	Date Required:
Email: Dylan.King@stantec.com	Email:	Site #:	Rush Confirmation #:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D. Nisbet	

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	13	13	8
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Analysis Requested

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	Phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic Plate Count	HOLD - DO NOT ANALYZE
1	MW16-9-6		2016/09/30	12:22	W	13		✓		✓	✓	✓														
2	MW16-25-9		↓	11:21	↓	↓		↓		↓	↓	↓														
3	MW16-11-15			14:02																						
4	MW16-2-6			13:01																						
5																										
6																										
7																										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

- ☑ AT1/CCME
- ☑ Drinking Water
- ☐ Saskatchewan
- ☐ D50 (Drilling Waste)
- ☐ Other:

Special Instructions

13° Please filter and preserve dissolved parameters for 13° MW16-2-6. Too turbid to field filter

Submitted same day as sampled

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
D. Nisbet	2016/09/30	15:56	Josh Kingsley	2016/09/30	1557

30-Sep-16 15:57
Wendy Sears
B686123
DN7 INS-0167

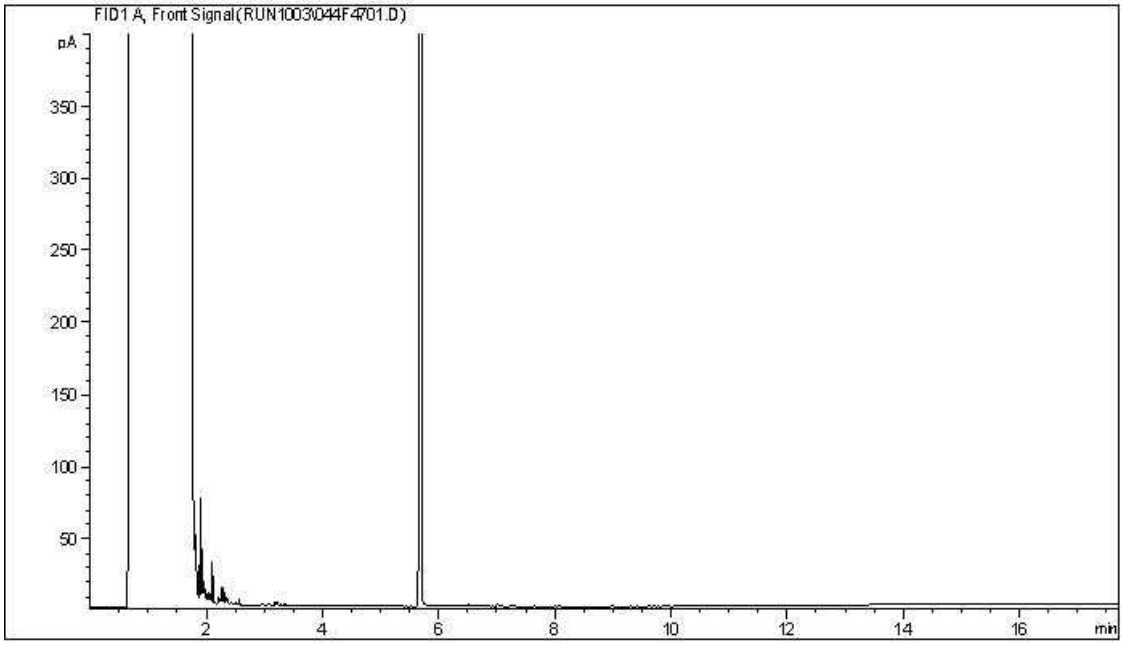
AB FCD-00331/6

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7066

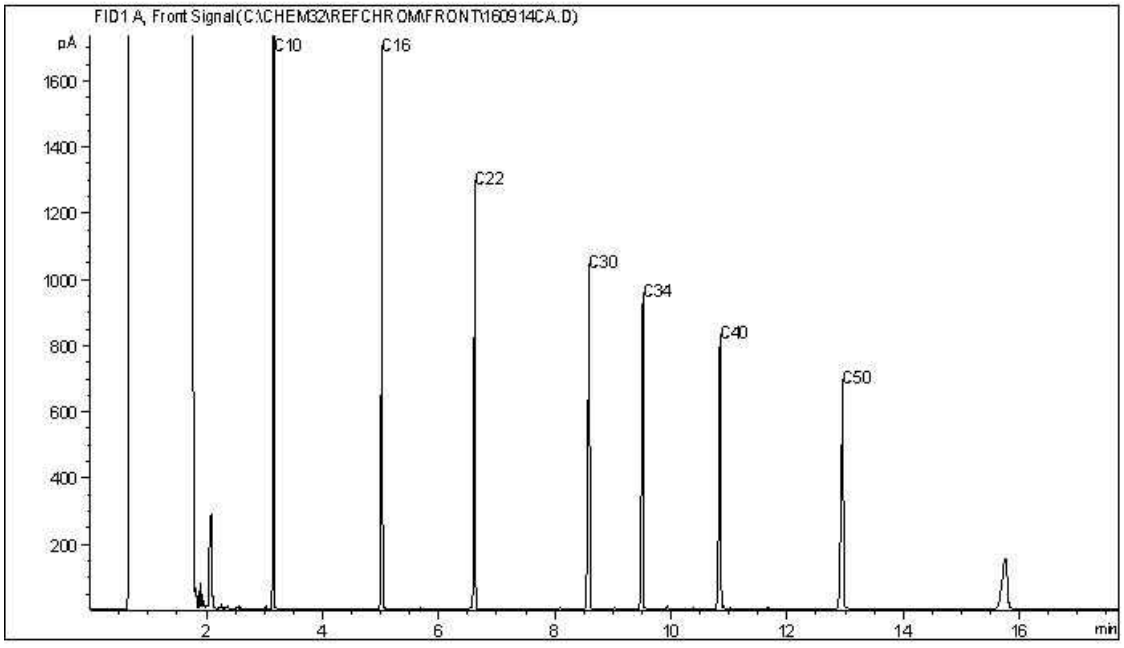
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-9-6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

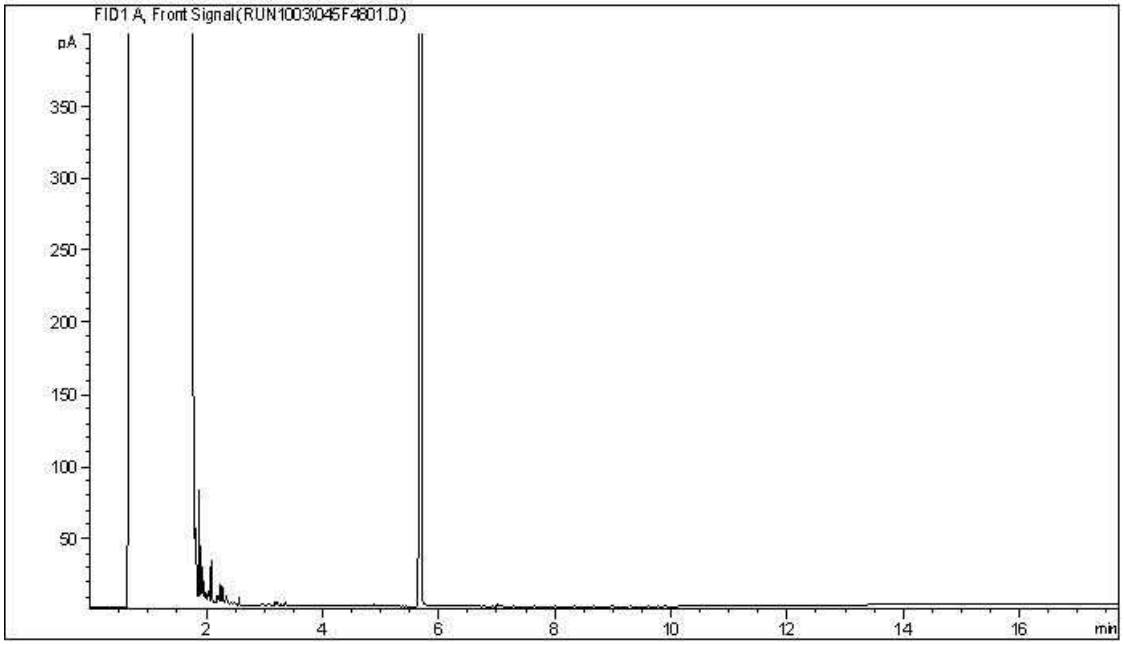
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7067

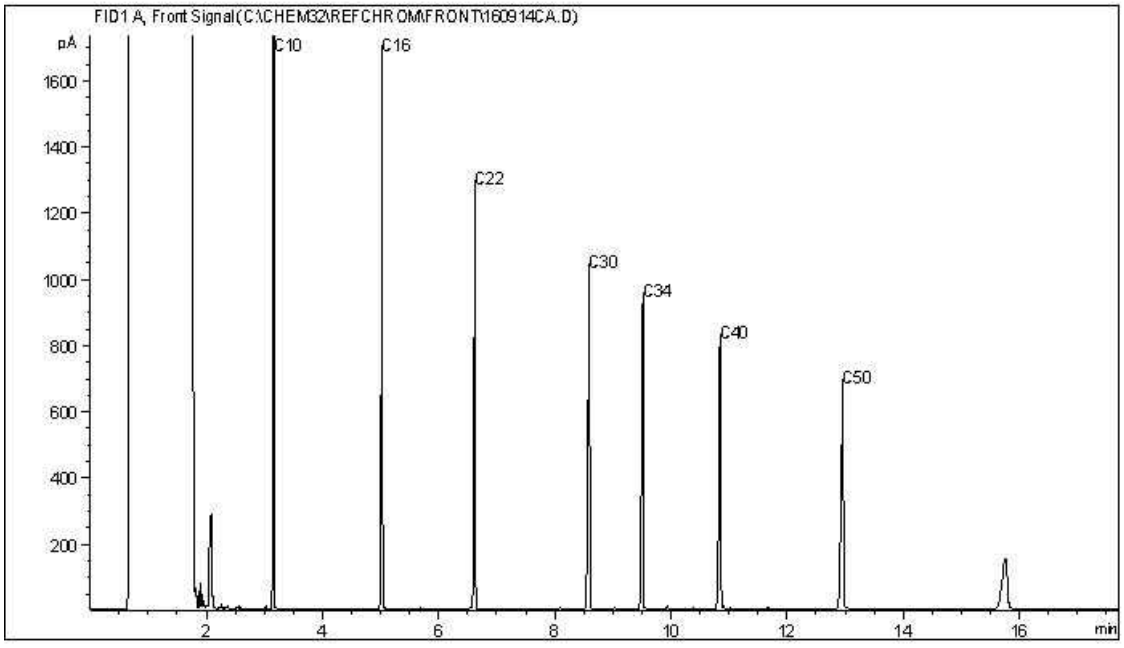
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-25-9

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

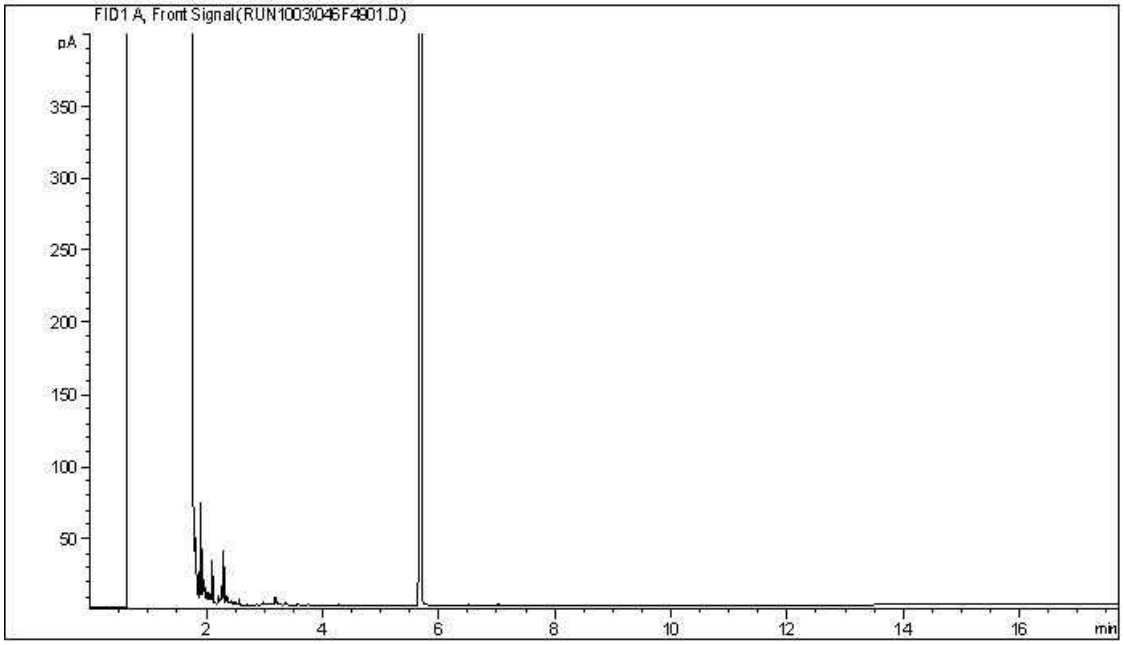
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7068

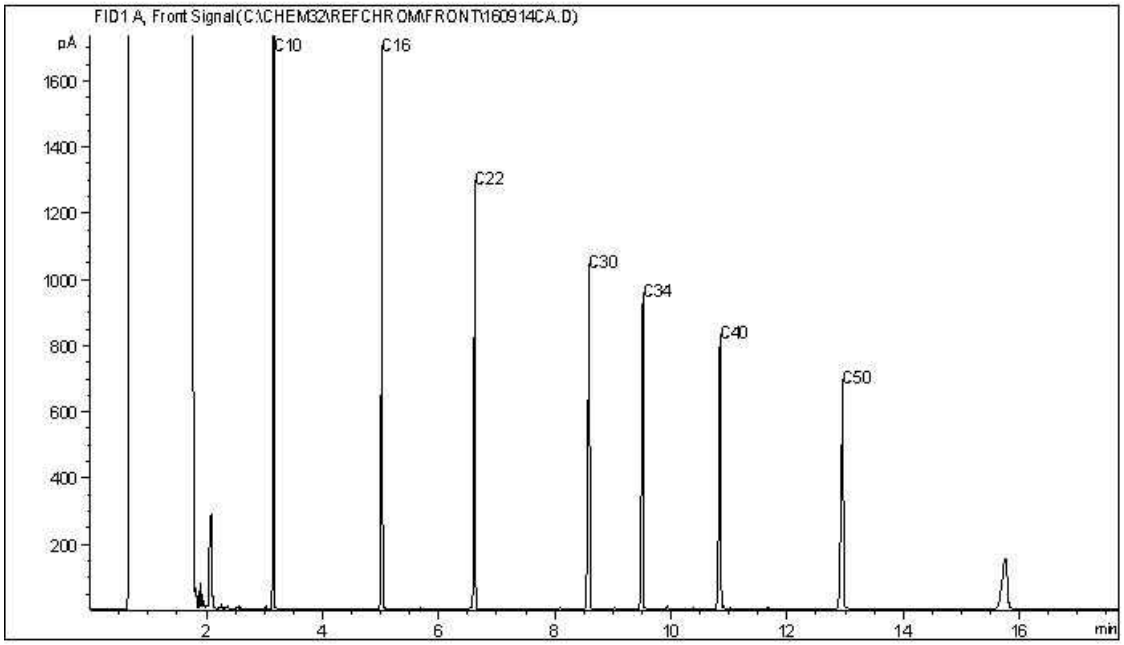
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-11-15

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

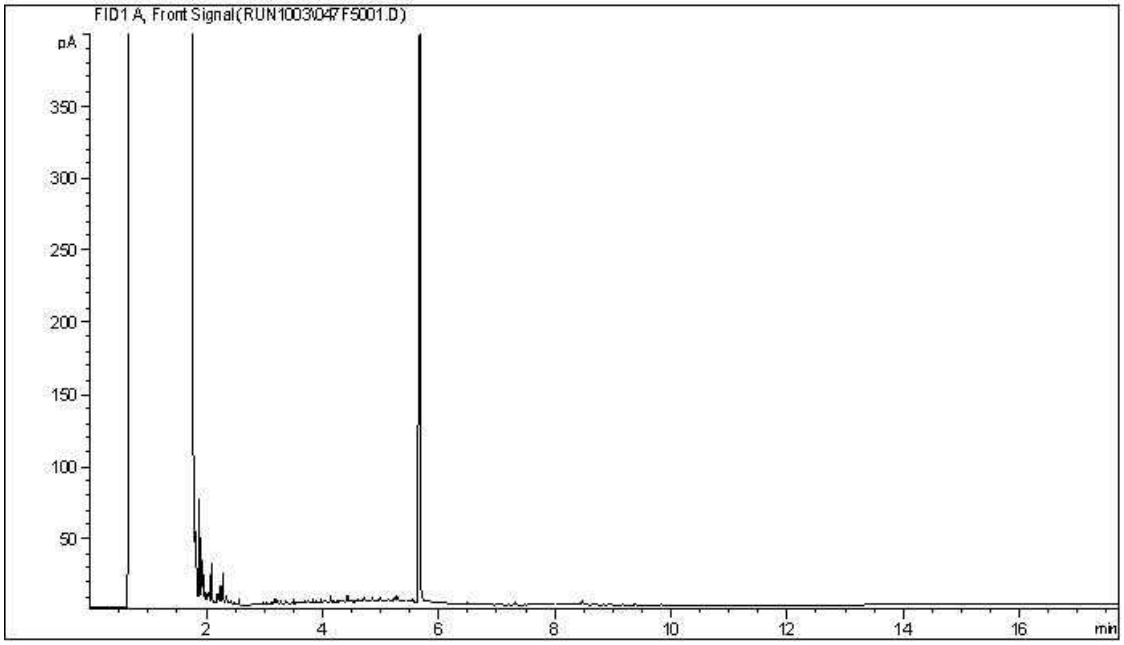
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7069

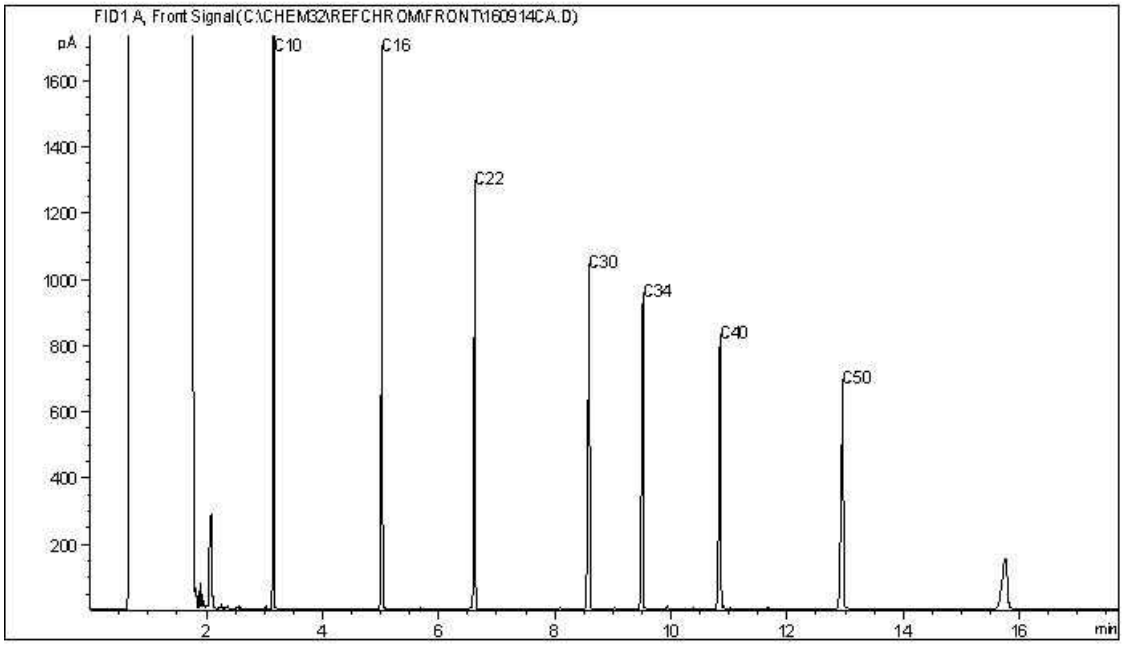
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-2-6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031938

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/12
Report #: R2280617
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686741
Received: 2016/10/03, 18:51

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2016/10/04	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	2	N/A	2016/10/08	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	2	N/A	2016/10/07	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	2	2016/10/04	2016/10/05	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	2	2016/10/04	2016/10/05	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/10/06	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	1	N/A	2016/10/06	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	2	N/A	2016/10/04	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	2	2016/10/05	2016/10/09	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Hardness	1	N/A	2016/10/07	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	1	2016/10/11	2016/10/11	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/10/04	2016/10/04	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	2	2016/10/11	2016/10/11	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	1	N/A	2016/10/07	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/05	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	1	N/A	2016/10/06	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/05	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	2	N/A	2016/10/04	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/10/07	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	1	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	2	N/A	2016/10/05	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	2	N/A	2016/10/05	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	2	N/A	2016/10/04	AB SOP-00023	SM 22 4110 B m
pH @25°C	2	N/A	2016/10/04	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	2	N/A	2016/10/04	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	2	N/A	2016/10/07	AB SOP-00018	SM 22 4500-SO4 E m

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031938

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/12
Report #: R2280617
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686741
Received: 2016/10/03, 18:51

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Heterotrophic Plate Count	2	2016/10/04	2016/10/06	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	2	N/A	2016/10/07	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	2	2016/10/06	2016/10/07	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/10/05	2016/10/05	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	1	2016/10/05	2016/10/06	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PR2485	PR2486		
Sampling Date		2016/10/03 14:07	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	MW16-1-15	MW16-16-11	RDL	QC Batch
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8422901
Volatiles					
Benzene	mg/L	<0.00040	0.0056	0.00040	8426391
Toluene	mg/L	<0.00040	0.024	0.00040	8426391
Ethylbenzene	mg/L	<0.00040	0.0034	0.00040	8426391
m & p-Xylene	mg/L	<0.00080	0.013	0.00080	8426391
o-Xylene	mg/L	<0.00040	0.0056	0.00040	8426391
Xylenes (Total)	mg/L	<0.00080	0.019	0.00080	8426391
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	8426391
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	8426391
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	100	101	N/A	8426391
4-Bromofluorobenzene (sur.)	%	97	97	N/A	8426391
D4-1,2-Dichloroethane (sur.)	%	99	96	N/A	8426391
O-TERPHENYL (sur.)	%	100	100	N/A	8422901

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2485		
Sampling Date		2016/10/03 14:07		
COC Number		M031938		
	UNITS	MW16-1-15	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	25	N/A	8419644
Cation Sum	meq/L	28	N/A	8419644
Hardness (CaCO3)	mg/L	1000	0.50	8420405
Ion Balance	N/A	1.1	0.010	8419643
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8420406
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8420407
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8420406
Calculated Total Dissolved Solids	mg/L	1600	10	8419648
Misc. Inorganics				
Conductivity	uS/cm	2100	1.0	8421412
pH	pH	7.88	N/A	8421411
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8421408
Alkalinity (Total as CaCO3)	mg/L	300	0.50	8421408
Bicarbonate (HCO3)	mg/L	360	0.50	8421408
Carbonate (CO3)	mg/L	<0.50	0.50	8421408
Hydroxide (OH)	mg/L	<0.50	0.50	8421408
Dissolved Sulphate (SO4)	mg/L	910 (1)	10	8426473
Dissolved Chloride (Cl)	mg/L	3.8	1.0	8426470
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8421070
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8421070
Elements				
Dissolved Aluminum (Al)	mg/L	<0.0030	0.0030	8421456
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8421456
Dissolved Arsenic (As)	mg/L	<0.00020	0.00020	8421456
Dissolved Barium (Ba)	mg/L	0.018	0.010	8424663
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8421456
Dissolved Boron (B)	mg/L	0.078	0.020	8424663

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2485		
Sampling Date		2016/10/03 14:07		
COC Number		M031938		
	UNITS	MW16-1-15	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8421456
Dissolved Calcium (Ca)	mg/L	230	0.30	8424663
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8421456
Dissolved Cobalt (Co)	mg/L	0.0012	0.00030	8421456
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8421456
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8424663
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8421456
Dissolved Lithium (Li)	mg/L	0.022	0.020	8424663
Dissolved Magnesium (Mg)	mg/L	110	0.20	8424663
Dissolved Manganese (Mn)	mg/L	0.88	0.0040	8424663
Dissolved Molybdenum (Mo)	mg/L	0.0028	0.00020	8421456
Dissolved Nickel (Ni)	mg/L	0.0010	0.00050	8421456
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8424663
Dissolved Potassium (K)	mg/L	4.8	0.30	8424663
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8421456
Dissolved Silicon (Si)	mg/L	4.7	0.10	8424663
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8421456
Dissolved Sodium (Na)	mg/L	160	0.50	8424663
Dissolved Strontium (Sr)	mg/L	1.6	0.020	8424663
Dissolved Sulphur (S)	mg/L	340	0.20	8424663
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8421456
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8421456
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8421456
Dissolved Uranium (U)	mg/L	0.0054	0.00010	8421456
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8421456
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8421456
RDL = Reportable Detection Limit				

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2486	PR2486		
Sampling Date		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	MW16-16-11	MW16-16-11 Lab-Dup	RDL	QC Batch
Calculated Parameters					
Anion Sum	meq/L	78	N/A	N/A	8419644
Cation Sum	meq/L	75	N/A	N/A	8419644
Hardness (CaCO3)	mg/L	2400	N/A	0.50	8420405
Ion Balance	N/A	0.95	N/A	0.010	8419643
Dissolved Nitrate (NO3)	mg/L	0.14	N/A	0.044	8420406
Nitrate plus Nitrite (N)	mg/L	0.031	N/A	0.020	8420407
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8420406
Calculated Total Dissolved Solids	mg/L	4900	N/A	10	8419648
Misc. Inorganics					
Conductivity	uS/cm	5400	N/A	1.0	8420879
pH	pH	7.57	N/A	N/A	8420878
Anions					
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8420877
Alkalinity (Total as CaCO3)	mg/L	630	N/A	0.50	8420877
Bicarbonate (HCO3)	mg/L	770	N/A	0.50	8420877
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8420877
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8420877
Dissolved Sulphate (SO4)	mg/L	3100 (1)	N/A	20	8426130
Dissolved Chloride (Cl)	mg/L	7.9	N/A	1.0	8426126
Nutrients					
Dissolved Nitrite (N)	mg/L	<0.010	N/A	0.010	8421070
Dissolved Nitrate (N)	mg/L	0.031	N/A	0.010	8421070
Lab Filtered Elements					
Dissolved Aluminum (Al)	mg/L	0.0056	0.0072	0.0030	8421584
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	8421584
Dissolved Arsenic (As)	mg/L	0.00085	0.00082	0.00020	8421584
Dissolved Barium (Ba)	mg/L	0.026	N/A	0.010	8421809
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	8421584

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2486	PR2486		
Sampling Date		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	MW16-16-11	MW16-16-11 Lab-Dup	RDL	QC Batch
Dissolved Boron (B)	mg/L	0.20	N/A	0.020	8421809
Dissolved Cadmium (Cd)	mg/L	0.00014 (1)	0.00011 (2)	0.000020	8421584
Dissolved Calcium (Ca)	mg/L	440	N/A	0.30	8421809
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	8421584
Dissolved Cobalt (Co)	mg/L	0.0037	0.0035	0.00030	8421584
Dissolved Copper (Cu)	mg/L	0.0097	0.0099	0.00020	8421584
Dissolved Iron (Fe)	mg/L	<0.060	N/A	0.060	8421809
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	8421584
Dissolved Lithium (Li)	mg/L	0.15	N/A	0.020	8421809
Dissolved Magnesium (Mg)	mg/L	320	N/A	0.20	8421809
Dissolved Manganese (Mn)	mg/L	2.3	N/A	0.0040	8421809
Dissolved Molybdenum (Mo)	mg/L	0.0011	0.0011	0.00020	8421584
Dissolved Nickel (Ni)	mg/L	0.0066	0.0062	0.00050	8421584
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8421809
Dissolved Potassium (K)	mg/L	15	N/A	0.30	8421809
Dissolved Selenium (Se)	mg/L	0.00038	0.00033	0.00020	8421584
Dissolved Silicon (Si)	mg/L	6.3	N/A	0.10	8421809
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	8421584
Dissolved Sodium (Na)	mg/L	600 (3)	N/A	5.0	8421809
Dissolved Strontium (Sr)	mg/L	4.9	N/A	0.020	8421809
Dissolved Sulphur (S)	mg/L	1000 (3)	N/A	2.0	8421809
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	8421584
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	8421584
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	0.0010	8421584
Dissolved Uranium (U)	mg/L	0.033	0.033	0.00010	8421584
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	8421584

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Duplicate exceeds acceptance criteria due to sample non homogeneity.
(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2486	PR2486		
Sampling Date		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	**MW16-16-11**	**MW16-16-11 Lab-Dup**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	<0.0030	<0.0030	0.0030	8421584

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR2485	PR2485		PR2486	PR2486		
Sampling Date		2016/10/03 14:07	2016/10/03 14:07		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		M031938	M031938		
	UNITS	MW16-1-15	MW16-1-15 Lab-Dup	RDL	MW16-16-11	MW16-16-11 Lab-Dup	RDL	QC Batch
Misc. Inorganics								
Dissolved Organic Carbon (C)	mg/L	2.6	N/A	0.50	N/A	N/A	0.50	8424431
Lab Filtered Inorganics								
Dissolved Organic Carbon (C)	mg/L	N/A	N/A	0.50	4.6	N/A	0.50	8424424
Microbiological Param.								
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	<100 (1)	N/A	100	8421073
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	<100 (1)	N/A	100	8421072
Heterotrophic Plate Count	CFU/mL	4900 (1)	5100	10	50000 (2)	52000	100	8421074
Total Coliforms DST	mpn/100mL	230 (1)	N/A	10	200 (1)	N/A	100	8421073
Nutrients								
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	N/A	N/A	N/A	8423168
Total Kjeldahl Nitrogen	mg/L	1.5 (3)	N/A	0.50	14 (3)	N/A	0.50	8424394
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	0.0045	N/A	0.0030	8421368
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	N/A	N/A	N/A	8422351
Lab Filtered Nutrients								
Dissolved Ammonia (N)	mg/L	N/A	N/A	N/A	0.60	N/A	0.050	8423178
Dissolved Phosphorus (P)	mg/L	N/A	N/A	N/A	0.011	N/A	0.0030	8422263

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
Spreader colonies were present in the Petri dish. Presence of spreader colonies may obscure other colonies, possibly biasing results.
(3) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PR2485		PR2486		
Sampling Date		2016/10/03 14:07		2016/10/03 17:32		
COC Number		M031938		M031938		
	UNITS	MW16-1-15	RDL	MW16-16-11	RDL	QC Batch
Low Level Elements						
Dissolved Mercury (Hg)	ug/L	0.0029	0.0020	N/A	0.0020	8428932
Total Mercury (Hg)	ug/L	<2.0 (1)	2.0	<6.0 (1)	6.0	8428935
Lab Filtered Elements-Low						
Dissolved Mercury (Hg)	ug/L	N/A	N/A	<0.0020	0.0020	8421467

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	12.3°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8420877	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/04		93	%	80 - 120
8420877	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/04	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/04	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/04	<0.50		mg/L	
			Carbonate (CO3)	2016/10/04	<0.50		mg/L	
			Hydroxide (OH)	2016/10/04	<0.50		mg/L	
8420877	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/04	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/04	0.43		%	20
			Bicarbonate (HCO3)	2016/10/04	0.43		%	20
			Carbonate (CO3)	2016/10/04	NC		%	20
			Hydroxide (OH)	2016/10/04	NC		%	20
8420878	IK0	Spiked Blank	pH	2016/10/04		100	%	97 - 103
8420878	IK0	RPD	pH	2016/10/04	0.22		%	N/A
8420879	IK0	Spiked Blank	Conductivity	2016/10/04		100	%	90 - 110
8420879	IK0	Method Blank	Conductivity	2016/10/04	<1.0		uS/cm	
8420879	IK0	RPD	Conductivity	2016/10/04	0.59		%	20
8421070	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/10/04		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/04		104	%	80 - 120
8421070	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/10/04		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/04		102	%	80 - 120
8421070	JLD	Method Blank	Dissolved Nitrite (N)	2016/10/04	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/04	<0.010		mg/L	
8421070	JLD	RPD	Dissolved Nitrite (N)	2016/10/04	NC		%	20
			Dissolved Nitrate (N)	2016/10/04	0.18		%	20
8421072	RP0	Method Blank	Fecal Coliforms	2016/10/05	<1.0		MPN/10	
8421072	RP0	RPD	Fecal Coliforms	2016/10/05	NC		%	N/A
8421073	AP1	Method Blank	E.Coli DST	2016/10/05	<1.0		mpn/100	
			Total Coliforms DST	2016/10/05	<1.0		mpn/100	
8421073	AP1	RPD	Total Coliforms DST	2016/10/05	NC		%	N/A
8421074	AP1	Method Blank	Heterotrophic Plate Count	2016/10/06	<1.0		CFU/mL	
8421074	AP1	RPD [PR2485-06]	Heterotrophic Plate Count	2016/10/06	3.6		%	N/A
8421074	AP1	RPD [PR2486-06]	Heterotrophic Plate Count	2016/10/06	3.1		%	N/A
8421368	MB5	Matrix Spike	Orthophosphate (P)	2016/10/04		92	%	80 - 120
8421368	MB5	Spiked Blank	Orthophosphate (P)	2016/10/04		94	%	80 - 120
8421368	MB5	Method Blank	Orthophosphate (P)	2016/10/04	<0.0030		mg/L	
8421368	MB5	RPD	Orthophosphate (P)	2016/10/04	NC		%	20
8421408	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/04		93	%	80 - 120
8421408	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/04	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/04	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/04	<0.50		mg/L	
			Carbonate (CO3)	2016/10/04	<0.50		mg/L	
			Hydroxide (OH)	2016/10/04	<0.50		mg/L	
8421408	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/04	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/04	NC		%	20
			Bicarbonate (HCO3)	2016/10/04	NC		%	20
			Carbonate (CO3)	2016/10/04	NC		%	20
			Hydroxide (OH)	2016/10/04	NC		%	20
8421411	IK0	Spiked Blank	pH	2016/10/04		100	%	97 - 103
8421411	IK0	RPD	pH	2016/10/04	0.98		%	N/A
8421412	IK0	Spiked Blank	Conductivity	2016/10/04		100	%	90 - 110
8421412	IK0	Method Blank	Conductivity	2016/10/04	<1.0		uS/cm	
8421412	IK0	RPD	Conductivity	2016/10/04	NC		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8421456	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/06		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		94	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		98	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		90	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		88	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		86	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		NC	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		92	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		89	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		97	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		97	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		92	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		93	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		88	%	80 - 120
8421456	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/06		121 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		94	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		102	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		102	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		101	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		100	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		97	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		100	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		99	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		98	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		90	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		105	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		93	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		101	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		99	%	80 - 120
8421456	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/05	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/05	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/05	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/05	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/05	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/05	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/05	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/05	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/05	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/05	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/05	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/05	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/05	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/05	<0.00020		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/10/05	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/05	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/05	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/05	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/05	<0.0030		mg/L	
8421456	PC5	RPD	Dissolved Aluminum (Al)	2016/10/06	NC		%	20
			Dissolved Antimony (Sb)	2016/10/06	NC		%	20
			Dissolved Arsenic (As)	2016/10/06	4.3		%	20
			Dissolved Beryllium (Be)	2016/10/06	NC		%	20
			Dissolved Chromium (Cr)	2016/10/06	NC		%	20
			Dissolved Cobalt (Co)	2016/10/06	NC		%	20
			Dissolved Copper (Cu)	2016/10/06	NC		%	20
			Dissolved Lead (Pb)	2016/10/06	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/06	NC		%	20
			Dissolved Nickel (Ni)	2016/10/06	0.53		%	20
			Dissolved Selenium (Se)	2016/10/06	NC		%	20
			Dissolved Silver (Ag)	2016/10/06	NC		%	20
			Dissolved Thallium (Tl)	2016/10/06	NC		%	20
			Dissolved Tin (Sn)	2016/10/06	NC		%	20
			Dissolved Titanium (Ti)	2016/10/06	NC		%	20
			Dissolved Uranium (U)	2016/10/06	2.0		%	20
			Dissolved Vanadium (V)	2016/10/06	NC		%	20
			Dissolved Zinc (Zn)	2016/10/06	NC		%	20
8421467	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/04		105	%	80 - 120
8421467	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/04		104	%	80 - 120
8421467	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/04	<0.0020		ug/L	
8421467	RK3	RPD	Dissolved Mercury (Hg)	2016/10/04	NC		%	20
8421584	PC5	Matrix Spike [PR2486-01]	Dissolved Aluminum (Al)	2016/10/05		111	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/05		93	%	80 - 120
			Dissolved Arsenic (As)	2016/10/05		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/05		94	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/05		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/05		92	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/05		90	%	80 - 120
			Dissolved Copper (Cu)	2016/10/05		90	%	80 - 120
			Dissolved Lead (Pb)	2016/10/05		93	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/05		103	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/05		87	%	80 - 120
			Dissolved Selenium (Se)	2016/10/05		96	%	80 - 120
			Dissolved Silver (Ag)	2016/10/05		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/05		93	%	80 - 120
			Dissolved Tin (Sn)	2016/10/05		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/05		96	%	80 - 120
			Dissolved Uranium (U)	2016/10/05		NC	%	80 - 120
			Dissolved Vanadium (V)	2016/10/05		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/05		89	%	80 - 120
8421584	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/05		121 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/05		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/05		96	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/05		95	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/05		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/05		100	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Cobalt (Co)	2016/10/05		100	%	80 - 120
			Dissolved Copper (Cu)	2016/10/05		98	%	80 - 120
			Dissolved Lead (Pb)	2016/10/05		102	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/05		100	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/05		101	%	80 - 120
			Dissolved Selenium (Se)	2016/10/05		101	%	80 - 120
			Dissolved Silver (Ag)	2016/10/05		99	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/05		102	%	80 - 120
			Dissolved Tin (Sn)	2016/10/05		103	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/05		100	%	80 - 120
			Dissolved Uranium (U)	2016/10/05		103	%	80 - 120
			Dissolved Vanadium (V)	2016/10/05		101	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/05		92	%	80 - 120
8421584	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/05	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/05	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/05	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/05	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/05	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/05	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/05	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/05	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/05	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/05	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/05	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/05	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/05	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/05	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/05	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/05	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/05	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/05	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/05	<0.0030		mg/L	
8421584	PC5	RPD [PR2486-01]	Dissolved Aluminum (Al)	2016/10/05	NC		%	20
			Dissolved Antimony (Sb)	2016/10/05	NC		%	20
			Dissolved Arsenic (As)	2016/10/05	NC		%	20
			Dissolved Beryllium (Be)	2016/10/05	NC		%	20
			Dissolved Cadmium (Cd)	2016/10/05	25 (1)		%	20
			Dissolved Chromium (Cr)	2016/10/05	NC		%	20
			Dissolved Cobalt (Co)	2016/10/05	6.8		%	20
			Dissolved Copper (Cu)	2016/10/05	1.8		%	20
			Dissolved Lead (Pb)	2016/10/05	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/05	2.8		%	20
			Dissolved Nickel (Ni)	2016/10/05	6.2		%	20
			Dissolved Selenium (Se)	2016/10/05	NC		%	20
			Dissolved Silver (Ag)	2016/10/05	NC		%	20
			Dissolved Thallium (Tl)	2016/10/05	NC		%	20
			Dissolved Tin (Sn)	2016/10/05	NC		%	20
			Dissolved Titanium (Ti)	2016/10/05	NC		%	20
			Dissolved Uranium (U)	2016/10/05	0.46		%	20
			Dissolved Vanadium (V)	2016/10/05	NC		%	20
			Dissolved Zinc (Zn)	2016/10/05	NC		%	20
8421809	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		104	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		100	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		95	%	80 - 120
8421809	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		100	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		103	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		96	%	80 - 120
8421809	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/05	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/05	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/05	<0.20		mg/L	
8421809	JHC	RPD	Dissolved Barium (Ba)	2016/10/05	NC		%	20
			Dissolved Boron (B)	2016/10/05	NC		%	20
			Dissolved Calcium (Ca)	2016/10/05	NC		%	20
			Dissolved Iron (Fe)	2016/10/05	NC		%	20
			Dissolved Lithium (Li)	2016/10/05	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/05	NC		%	20
			Dissolved Manganese (Mn)	2016/10/05	NC		%	20
			Dissolved Phosphorus (P)	2016/10/05	NC		%	20
			Dissolved Potassium (K)	2016/10/05	NC		%	20
			Dissolved Silicon (Si)	2016/10/05	NC		%	20
			Dissolved Sodium (Na)	2016/10/05	NC		%	20
			Dissolved Strontium (Sr)	2016/10/05	NC		%	20
			Dissolved Sulphur (S)	2016/10/05	NC		%	20
8422263	MB5	Matrix Spike	Dissolved Phosphorus (P)	2016/10/05		94	%	80 - 120
8422263	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
8422263	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/05		103	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8422263	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/05	<0.0030		mg/L	
8422263	MB5	RPD	Dissolved Phosphorus (P)	2016/10/05	NC		%	20
8422351	MB5	Matrix Spike	Dissolved Phosphorus (P)	2016/10/06		22 (1)	%	80 - 120
8422351	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/06		107	%	80 - 120
8422351	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/06		105	%	80 - 120
8422351	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/06	<0.0030		mg/L	
8422351	MB5	RPD	Dissolved Phosphorus (P)	2016/10/06	NC		%	20
8422901	VP4	Matrix Spike	O-TERPHENYL (sur.)	2016/10/08		102	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	50 - 130
8422901	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/10/08		103	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	70 - 130
8422901	VP4	Method Blank	O-TERPHENYL (sur.)	2016/10/08		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08	<0.10		mg/L	
8422901	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/08	NC		%	40
8423168	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/10/05		93	%	80 - 120
8423168	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		94	%	80 - 120
8423168	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423168	MB5	RPD	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8423178	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/10/06		83	%	80 - 120
8423178	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		97	%	80 - 120
8423178	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423178	MB5	RPD	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8424394	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/07		NC	%	80 - 120
8424394	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/07		89	%	80 - 120
8424394	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/07		84	%	80 - 120
8424394	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/07	<0.050		mg/L	
8424394	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/07	2.0		%	20
8424424	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/06		NC	%	80 - 120
8424424	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/06		99	%	80 - 120
8424424	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/06	<0.50		mg/L	
8424424	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/06	2.4		%	20
8424431	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/06		NC	%	80 - 120
8424431	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/06		103	%	80 - 120
8424431	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/06	<0.50		mg/L	
8424431	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/06	1.7		%	20
8424663	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/06		95	%	80 - 120
			Dissolved Boron (B)	2016/10/06		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/06		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/06		94	%	80 - 120
			Dissolved Lithium (Li)	2016/10/06		99	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/06		NC	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/06		96	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/06		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/06		107	%	80 - 120
			Dissolved Silicon (Si)	2016/10/06		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/06		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/06		NC	%	80 - 120
8424663	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/06		100	%	80 - 120
			Dissolved Boron (B)	2016/10/06		94	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/06		102	%	80 - 120
			Dissolved Iron (Fe)	2016/10/06		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/06		101	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Magnesium (Mg)	2016/10/06		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/06		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/06		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/06		108	%	80 - 120
			Dissolved Silicon (Si)	2016/10/06		96	%	80 - 120
			Dissolved Sodium (Na)	2016/10/06		102	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/06		98	%	80 - 120
8424663	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/06	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/06	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/06	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/06	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/06	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/06	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/06	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/06	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/06	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/06	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/06	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/06	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/06	<0.20		mg/L	
8424663	JHC	RPD	Dissolved Calcium (Ca)	2016/10/07	0.86		%	20
			Dissolved Iron (Fe)	2016/10/07	2.1		%	20
			Dissolved Magnesium (Mg)	2016/10/07	0.073		%	20
			Dissolved Manganese (Mn)	2016/10/07	0.30		%	20
			Dissolved Potassium (K)	2016/10/07	0.63		%	20
			Dissolved Sodium (Na)	2016/10/07	0.074		%	20
8426126	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/07		NC	%	80 - 120
8426126	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/07		104	%	80 - 120
8426126	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/07	1.4, RDL=1.0		mg/L	
8426126	ZI	RPD	Dissolved Chloride (Cl)	2016/10/07	8.6		%	20
8426130	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/07		NC	%	80 - 120
8426130	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/07		106	%	80 - 120
8426130	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/07	<1.0		mg/L	
8426130	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/07	0.50		%	20
8426391	MZ	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/08		99	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		98	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		96	%	70 - 130
			Benzene	2016/10/08		100	%	70 - 130
			Toluene	2016/10/08		98	%	70 - 130
			Ethylbenzene	2016/10/08		100	%	70 - 130
			m & p-Xylene	2016/10/08		90	%	70 - 130
			o-Xylene	2016/10/08		99	%	70 - 130
			F1 (C6-C10)	2016/10/08		84	%	70 - 130
8426391	MZ	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/08		99	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		97	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		95	%	70 - 130
			Benzene	2016/10/08		98	%	70 - 130
			Toluene	2016/10/08		97	%	70 - 130
			Ethylbenzene	2016/10/08		99	%	70 - 130
			m & p-Xylene	2016/10/08		88	%	70 - 130
			o-Xylene	2016/10/08		102	%	70 - 130

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/08		105	%	70 - 130
8426391	MZ	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/08		100	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		96	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		96	%	70 - 130
			Benzene	2016/10/08	<0.00040		mg/L	
			Toluene	2016/10/08	<0.00040		mg/L	
			Ethylbenzene	2016/10/08	<0.00040		mg/L	
			m & p-Xylene	2016/10/08	<0.00080		mg/L	
			o-Xylene	2016/10/08	<0.00040		mg/L	
			Xylenes (Total)	2016/10/08	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/08	<0.10		mg/L	
			F1 (C6-C10)	2016/10/08	<0.10		mg/L	
8426391	MZ	RPD	Benzene	2016/10/08	NC		%	40
			Toluene	2016/10/08	NC		%	40
			Ethylbenzene	2016/10/08	NC		%	40
			m & p-Xylene	2016/10/08	NC		%	40
			o-Xylene	2016/10/08	NC		%	40
			Xylenes (Total)	2016/10/08	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/08	NC		%	40
			F1 (C6-C10)	2016/10/08	NC		%	40
8426470	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/07		NC	%	80 - 120
8426470	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/07		101	%	80 - 120
8426470	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/07	<1.0		mg/L	
8426470	ZI	RPD	Dissolved Chloride (Cl)	2016/10/07	6.0		%	20
8426473	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/07		NC	%	80 - 120
8426473	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/07		103	%	80 - 120
8426473	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/07	<1.0		mg/L	
8426473	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/07	0.075		%	20
8428932	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/11		107	%	80 - 120
8428932	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/11		120	%	80 - 120
8428932	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/11	0.0030, RDL=0.0020		ug/L	
8428932	RK3	RPD	Dissolved Mercury (Hg)	2016/10/11	NC		%	20
8428935	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/11		114	%	80 - 120
8428935	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/11		108	%	80 - 120
8428935	RK3	Method Blank	Total Mercury (Hg)	2016/10/11	<0.0020		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428935	RK3	RPD	Total Mercury (Hg)	2016/10/11	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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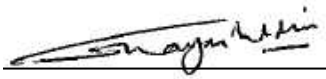
VALIDATION SIGNATURE PAGE

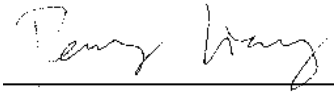
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics



Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
A Bureau Veritas Group Company

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maxxam.ca

CHAIN OF CUSTODY RECORD

M031938

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Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required
Company :	Stantec Consulting Ltd	Company:		Quotation #:		☑ 5-7 Days Regular (Most analyses)
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	10160 112 St, Edmonton AB, T5K 2L6	Address:		Project #:	110773396	Rush TAT (Surcharges will be applied) ☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Phone:	(780) 969-2223	Phone:		Site Location:	Springbank SR1	
Email:	Dylan.King@stantec.com	Email:		Site #:		Date Required:
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact	✓		Temp	10	14	13
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Regulatory Criteria

☑ AT1/CCME
☑ Drinking Water
☐ Saskatchewan
☐ D50 (Drilling Waste)
☐ Other:

Special Instructions

For MW16-16-11 please take dissolved parameters out of Routine Bottle due to low sample volume.

Submitted same day as sampled

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☑	Mercury Total ☐ Dissolved ☑	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved Phosphorous Phosphate	Dissolved Ammonia TKN	DOC	Total Coliforms	E. coli	Fecal Coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-1-15		2016/10/03	14:07	W	13		✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	
2	MW16-16-11		2016/10/03	17:32	W	10		✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10									MW16-1-15								10	11	12					
	Please indicate Filtered, Preserved or Both (F, P, F/P) →								MW16-16-11								14	12	10					

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
Dale Nisbet / Dale Nisbet	2016/10/03	19:50	Shipped by NATIVE EXPRESS COURIER	2016/10/03	18:51

03-Oct-16 18:51
Wendy Sears
B686741
NB6 INS-0001

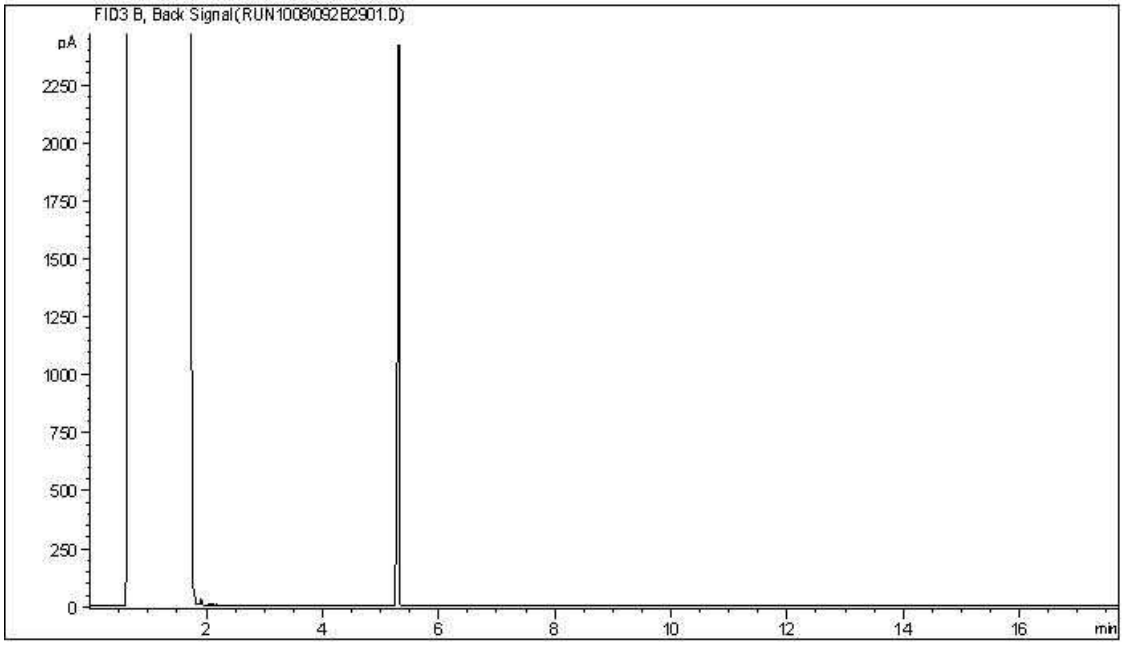
AB FCD-00331/6

Maxxam Job #: B686741
Report Date: 2016/10/12
Maxxam Sample: PR2485

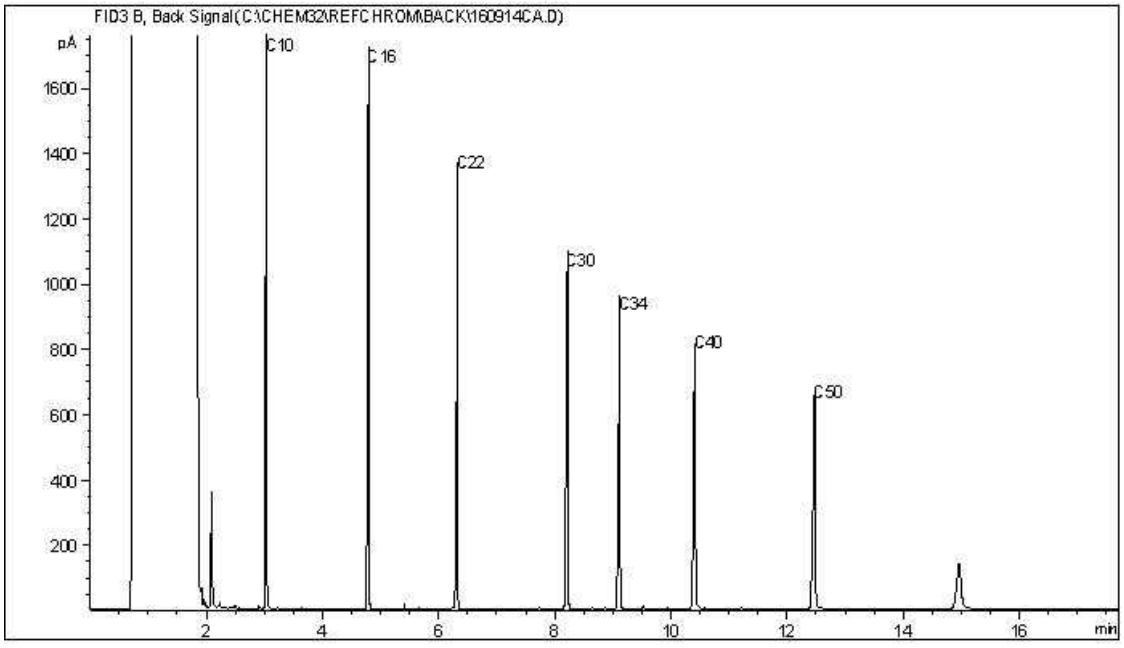
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-1-15

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

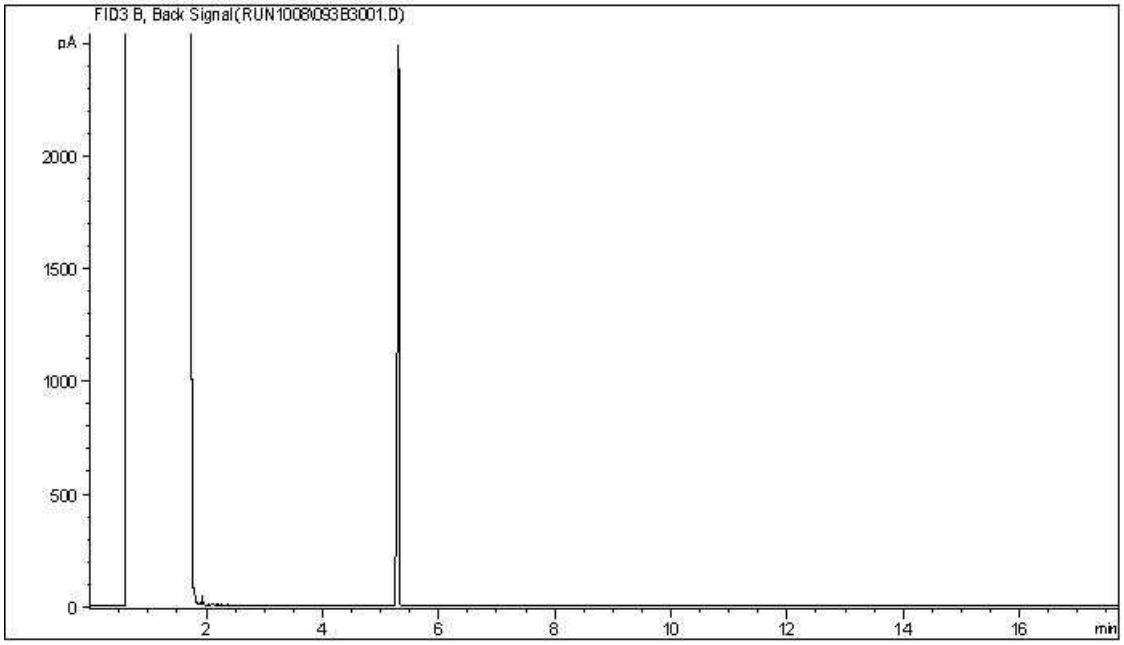
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686741
Report Date: 2016/10/12
Maxxam Sample: PR2486

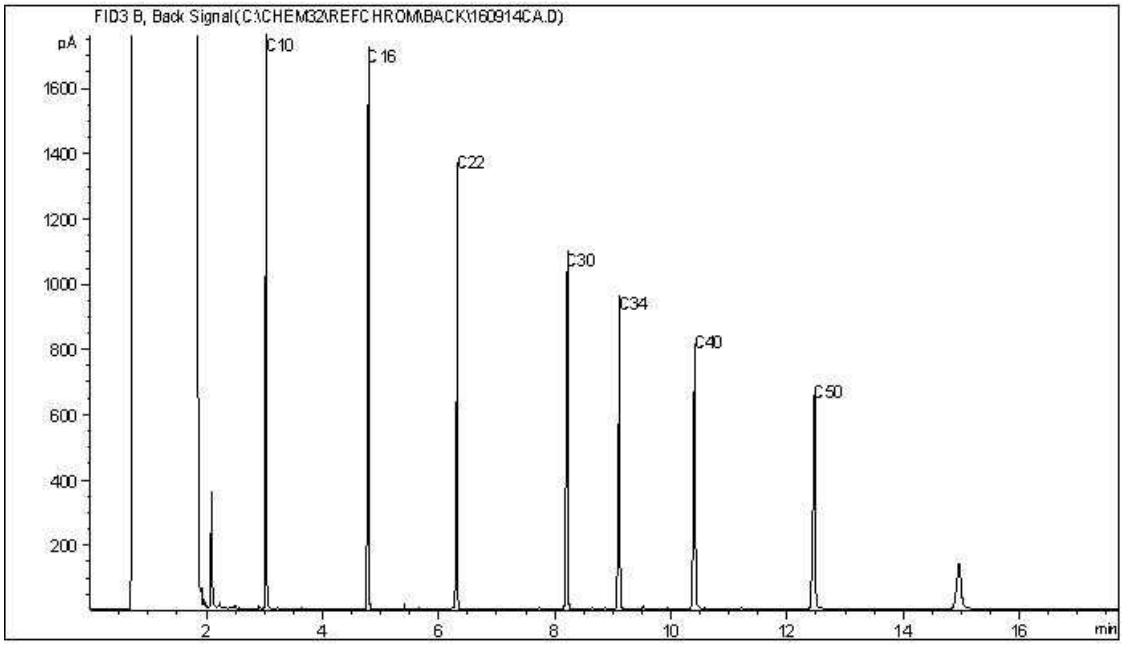
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-16-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031942

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/13
Report #: R2281727
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B687243
Received: 2016/10/04, 18:07

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	8	N/A	2016/10/05	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	8	N/A	2016/10/12	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	8	N/A	2016/10/08	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	8	2016/10/05	2016/10/06	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	8	2016/10/05	2016/10/06	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/10/07	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	7	N/A	2016/10/06	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	7	N/A	2016/10/05	AB SOP-00005	SM 22 2510 B m
Conductivity @25C	1	N/A	2016/10/11	AB SOP-00004	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	6	2016/10/05	2016/10/09	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	2	2016/10/05	2016/10/10	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	8	N/A	2016/10/08	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	7	2016/10/12	2016/10/12	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/10/13	2016/10/13	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	8	2016/10/11	2016/10/11	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	7	N/A	2016/10/08	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/07	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	7	N/A	2016/10/06	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/07	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	8	N/A	2016/10/06	AB WI-00065	Auto Calc
Sum of cations, anions	8	N/A	2016/10/08	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/10/09	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	7	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	8	N/A	2016/10/07	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	8	N/A	2016/10/07	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	8	N/A	2016/10/06	AB SOP-00023	SM 22 4110 B m
pH @25°C	7	N/A	2016/10/05	AB SOP-00005	SM 22 4500-H+B m
pH @25C	1	N/A	2016/10/11	AB SOP-00006	SM 22 4500 H+B m
Orthophosphate by Konelab	8	N/A	2016/10/06	AB SOP-00025	SM 22 4500-P A,F m

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031942

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/13
Report #: R2281727
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B687243
Received: 2016/10/04, 18:07

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sulphate by Automated Colourimetry	8	N/A	2016/10/08	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	8	2016/10/05	2016/10/07	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	8	N/A	2016/10/08	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	2	2016/10/07	2016/10/07	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	6	2016/10/10	2016/10/12	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/10/06	2016/10/09	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	7	2016/10/05	2016/10/06	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PR5499	PR5500	PR5501	PR5502	PR5503	PR5504		
Sampling Date		2016/10/04 10:50	2016/10/04 10:10	2016/10/04 12:14	2016/10/04 13:16	2016/10/04 15:04	2016/10/04 16:12		
COC Number		M031942	M031942	M031942	M031942	M031942	M031942		
	UNITS	MW16-18-6	MW16-18-10	MW16-4-20	MW16-5-11	MW16-10-15	MW16-8-8	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8422901
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	0.00055	<0.00040	<0.00040	0.00040	8428043
Toluene	mg/L	<0.00040	0.0013	<0.00040	0.0013	<0.00040	<0.00040	0.00040	8428043
Ethylbenzene	mg/L	0.00062	0.00068	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8428043
m & p-Xylene	mg/L	0.0020	0.0029	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8428043
o-Xylene	mg/L	0.0010	0.0012	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8428043
Xylenes (Total)	mg/L	0.0030	0.0041	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8428043
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8428043
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8428043
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	104	107	106	106	107	106	N/A	8428043
4-Bromofluorobenzene (sur.)	%	100	100	100	99	102	101	N/A	8428043
D4-1,2-Dichloroethane (sur.)	%	102	101	102	100	102	100	N/A	8428043
O-TERPHENYL (sur.)	%	97	97	98	95	97	98	N/A	8422901

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PR5505	PR5506		
Sampling Date		2016/10/04 16:06	2016/10/04 12:15		
COC Number		M031942	M031942		
	UNITS	MW16-8-19	MW16-4-16	RDL	QC Batch
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8422901
Volatiles					
Benzene	mg/L	<0.00040	<0.00040	0.00040	8428043
Toluene	mg/L	<0.00040	<0.00040	0.00040	8428043
Ethylbenzene	mg/L	<0.00040	<0.00040	0.00040	8428043
m & p-Xylene	mg/L	<0.00080	<0.00080	0.00080	8428043
o-Xylene	mg/L	<0.00040	<0.00040	0.00040	8428043
Xylenes (Total)	mg/L	<0.00080	<0.00080	0.00080	8428043
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	8428043
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	8428043
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	105	107	N/A	8428043
4-Bromofluorobenzene (sur.)	%	101	102	N/A	8428043
D4-1,2-Dichloroethane (sur.)	%	100	103	N/A	8428043
O-TERPHENYL (sur.)	%	97	95	N/A	8422901

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5499	PR5499	PR5500		PR5501		
Sampling Date		2016/10/04 10:50	2016/10/04 10:50	2016/10/04 10:10		2016/10/04 12:14		
COC Number		M031942	M031942	M031942		M031942		
	UNITS	MW16-18-6	MW16-18-6 Lab-Dup	MW16-18-10	RDL	MW16-4-20	RDL	QC Batch
Calculated Parameters								
Anion Sum	meq/L	13	N/A	13	N/A	54	N/A	8421120
Cation Sum	meq/L	12	N/A	12	N/A	50	N/A	8421120
Hardness (CaCO3)	mg/L	480	N/A	160	0.50	1700	0.50	8422175
Ion Balance	N/A	0.98	N/A	0.93	0.010	0.94	0.010	8421119
Dissolved Nitrate (NO3)	mg/L	5.3	N/A	0.51	0.044	<0.044	0.044	8421045
Nitrate plus Nitrite (N)	mg/L	1.2	N/A	0.13	0.020	<0.020	0.020	8421046
Dissolved Nitrite (NO2)	mg/L	0.10	N/A	0.054	0.033	<0.033	0.033	8421045
Calculated Total Dissolved Solids	mg/L	650	N/A	680	10	3400	10	8421121
Misc. Inorganics								
Conductivity	uS/cm	1100	N/A	1200	1.0	4000	1.0	8422994
pH	pH	8.01	N/A	8.10	N/A	7.52	N/A	8422993
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	<0.50	0.50	<0.50	0.50	8422991
Alkalinity (Total as CaCO3)	mg/L	420	N/A	410	0.50	460	0.50	8422991
Bicarbonate (HCO3)	mg/L	510	N/A	500	0.50	570	0.50	8422991
Carbonate (CO3)	mg/L	<0.50	N/A	<0.50	0.50	<0.50	0.50	8422991
Hydroxide (OH)	mg/L	<0.50	N/A	<0.50	0.50	<0.50	0.50	8422991
Dissolved Sulphate (SO4)	mg/L	100	100	110	1.0	2100 (1)	20	8427521
Dissolved Chloride (Cl)	mg/L	72	69	78	1.0	3.0	1.0	8427519
Nutrients								
Dissolved Nitrite (N)	mg/L	0.031	N/A	0.017	0.010	<0.010	0.010	8423525
Dissolved Nitrate (N)	mg/L	1.2	N/A	0.12	0.010	<0.010	0.010	8423525
Elements								
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	<0.0030	0.0030	<0.0030	0.0030	8422814
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	<0.00060	0.00060	<0.00060	0.00060	8422814
Dissolved Arsenic (As)	mg/L	0.00022	N/A	0.00039	0.00020	0.0017	0.00020	8422814
Dissolved Barium (Ba)	mg/L	0.075	N/A	0.030	0.010	<0.010	0.010	8426610
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Boron (B)	mg/L	0.088	N/A	0.14	0.020	0.11	0.020	8426610

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5499	PR5499	PR5500		PR5501		
Sampling Date		2016/10/04 10:50	2016/10/04 10:50	2016/10/04 10:10		2016/10/04 12:14		
COC Number		M031942	M031942	M031942		M031942		
	UNITS	MW16-18-6	MW16-18-6 Lab-Dup	MW16-18-10	RDL	MW16-4-20	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	<0.000020	N/A	<0.000020	0.000020	<0.000020	0.000020	8422814
Dissolved Calcium (Ca)	mg/L	86	N/A	38	0.30	380	0.30	8426610
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Cobalt (Co)	mg/L	<0.00030	N/A	0.00034	0.00030	0.00034	0.00030	8422814
Dissolved Copper (Cu)	mg/L	0.00067	N/A	<0.00020	0.00020	<0.00020	0.00020	8422814
Dissolved Iron (Fe)	mg/L	<0.060	N/A	<0.060	0.060	2.2	0.060	8426610
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	<0.00020	0.00020	<0.00020	0.00020	8422814
Dissolved Lithium (Li)	mg/L	0.026	N/A	0.031	0.020	0.070	0.020	8426610
Dissolved Magnesium (Mg)	mg/L	63	N/A	16	0.20	180	0.20	8426610
Dissolved Manganese (Mn)	mg/L	0.058	N/A	0.20	0.0040	0.60	0.0040	8426610
Dissolved Molybdenum (Mo)	mg/L	0.0019	N/A	0.0037	0.00020	0.0016	0.00020	8422814
Dissolved Nickel (Ni)	mg/L	0.00099	N/A	<0.00050	0.00050	<0.00050	0.00050	8422814
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	<0.10	0.10	<0.10	0.10	8426610
Dissolved Potassium (K)	mg/L	2.4	N/A	1.3	0.30	8.2	0.30	8426610
Dissolved Selenium (Se)	mg/L	0.0012	N/A	0.00066	0.00020	<0.00020	0.00020	8422814
Dissolved Silicon (Si)	mg/L	4.1	N/A	3.4	0.10	4.3	0.10	8426610
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	<0.00010	0.00010	<0.00010	0.00010	8422814
Dissolved Sodium (Na)	mg/L	66	N/A	200	0.50	370	0.50	8426610
Dissolved Strontium (Sr)	mg/L	0.75	N/A	0.27	0.020	6.0 (1)	0.20	8426610
Dissolved Sulphur (S)	mg/L	29	N/A	33	0.20	730 (1)	2.0	8426610
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	<0.00020	0.00020	<0.00020	0.00020	8422814
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Uranium (U)	mg/L	0.011	N/A	0.0064	0.00010	0.0023	0.00010	8422814
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	<0.0030	0.0030	<0.0030	0.0030	8422814

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5502	PR5502		PR5503		PR5503	
Sampling Date		2016/10/04 13:16	2016/10/04 13:16		2016/10/04 15:04		2016/10/04 15:04	
COC Number		M031942	M031942		M031942		M031942	
	UNITS	MW16-5-11	MW16-5-11 Lab-Dup	QC Batch	MW16-10-15	RDL	MW16-10-15 Lab-Dup	QC Batch
Calculated Parameters								
Anion Sum	meq/L	8.8	N/A	8421120	N/A	N/A	N/A	8421120
Cation Sum	meq/L	8.7	N/A	8421120	N/A	N/A	N/A	8421120
Hardness (CaCO3)	mg/L	340	N/A	8422175	N/A	0.50	N/A	8422175
Ion Balance	N/A	0.99	N/A	8421119	N/A	0.010	N/A	8421119
Dissolved Nitrate (NO3)	mg/L	3.3	N/A	8421045	N/A	0.044	N/A	8421045
Nitrate plus Nitrite (N)	mg/L	0.76	N/A	8421046	N/A	0.020	N/A	8421046
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	8421045	N/A	0.033	N/A	8421045
Calculated Total Dissolved Solids	mg/L	440	N/A	8421121	N/A	10	N/A	8421121
Misc. Inorganics								
Conductivity	uS/cm	780	N/A	8422994	3000	1.0	N/A	8429611
pH	pH	7.96	N/A	8422993	7.65	N/A	7.62	8429487
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	8422991	N/A	0.50	N/A	N/A
Alkalinity (Total as CaCO3)	mg/L	380	N/A	8422991	N/A	0.50	N/A	N/A
Bicarbonate (HCO3)	mg/L	470	N/A	8422991	N/A	0.50	N/A	N/A
Carbonate (CO3)	mg/L	<0.50	N/A	8422991	N/A	0.50	N/A	N/A
Hydroxide (OH)	mg/L	<0.50	N/A	8422991	N/A	0.50	N/A	N/A
Dissolved Sulphate (SO4)	mg/L	43	N/A	8427480	N/A	1.0	N/A	N/A
Dissolved Chloride (Cl)	mg/L	4.8	N/A	8427477	N/A	1.0	N/A	N/A
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	N/A	8423525	N/A	0.010	N/A	N/A
Dissolved Nitrate (N)	mg/L	0.76	N/A	8423525	N/A	0.010	N/A	N/A
Elements								
Dissolved Aluminum (Al)	mg/L	0.011	N/A	8422814	N/A	0.0030	N/A	N/A
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	8422814	N/A	0.00060	N/A	N/A
Dissolved Arsenic (As)	mg/L	0.0010	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Barium (Ba)	mg/L	0.068	0.068	8426625	N/A	0.010	N/A	N/A
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Boron (B)	mg/L	0.036	0.035	8426625	N/A	0.020	N/A	N/A
Dissolved Cadmium (Cd)	mg/L	<0.000020	N/A	8422814	N/A	0.000020	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5502	PR5502		PR5503		PR5503	
Sampling Date		2016/10/04 13:16	2016/10/04 13:16		2016/10/04 15:04		2016/10/04 15:04	
COC Number		M031942	M031942		M031942		M031942	
	UNITS	MW16-5-11	MW16-5-11 Lab-Dup	QC Batch	MW16-10-15	RDL	MW16-10-15 Lab-Dup	QC Batch
Dissolved Calcium (Ca)	mg/L	76	76	8426625	N/A	0.30	N/A	N/A
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Cobalt (Co)	mg/L	0.0010	N/A	8422814	N/A	0.00030	N/A	N/A
Dissolved Copper (Cu)	mg/L	<0.00020	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Iron (Fe)	mg/L	0.061	0.062	8426625	N/A	0.060	N/A	N/A
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	8426625	N/A	0.020	N/A	N/A
Dissolved Magnesium (Mg)	mg/L	38	38	8426625	N/A	0.20	N/A	N/A
Dissolved Manganese (Mn)	mg/L	0.15	0.15	8426625	N/A	0.0040	N/A	N/A
Dissolved Molybdenum (Mo)	mg/L	0.012	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Nickel (Ni)	mg/L	0.0020	N/A	8422814	N/A	0.00050	N/A	N/A
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	8426625	N/A	0.10	N/A	N/A
Dissolved Potassium (K)	mg/L	3.7	3.7	8426625	N/A	0.30	N/A	N/A
Dissolved Selenium (Se)	mg/L	0.0031	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Silicon (Si)	mg/L	4.2	4.1	8426625	N/A	0.10	N/A	N/A
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	8422814	N/A	0.00010	N/A	N/A
Dissolved Sodium (Na)	mg/L	39	39	8426625	N/A	0.50	N/A	N/A
Dissolved Strontium (Sr)	mg/L	0.82	0.81	8426625	N/A	0.020	N/A	N/A
Dissolved Sulphur (S)	mg/L	13	13	8426625	N/A	0.20	N/A	N/A
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Uranium (U)	mg/L	0.0053	N/A	8422814	N/A	0.00010	N/A	N/A
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	8422814	N/A	0.0030	N/A	N/A

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Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5504		PR5505			PR5506		
Sampling Date		2016/10/04 16:12		2016/10/04 16:06			2016/10/04 12:15		
COC Number		M031942		M031942			M031942		
	UNITS	MW16-8-8	QC Batch	MW16-8-19	RDL	QC Batch	MW16-4-16	RDL	QC Batch
Calculated Parameters									
Anion Sum	meq/L	12	8421120	15	N/A	8421120	55	N/A	8421120
Cation Sum	meq/L	12	8421120	14	N/A	8421120	51	N/A	8421120
Hardness (CaCO3)	mg/L	550	8422175	580	0.50	8422175	1700	0.50	8422175
Ion Balance	N/A	1.0	8421119	0.93	0.010	8422190	0.94	0.010	8422190
Dissolved Nitrate (NO3)	mg/L	6.9	8421045	3.1	0.044	8422191	0.045	0.044	8422191
Nitrate plus Nitrite (N)	mg/L	1.6	8421046	0.70	0.020	8422192	<0.020	0.020	8422192
Dissolved Nitrite (NO2)	mg/L	<0.033	8421045	<0.033	0.033	8422191	<0.033	0.033	8422191
Calculated Total Dissolved Solids	mg/L	640	8421121	750	10	8422193	3400	10	8422193
Misc. Inorganics									
Conductivity	uS/cm	1100	8422994	1300	1.0	8422994	4000	1.0	8422994
pH	pH	7.90	8422993	7.74	N/A	8422993	7.45	N/A	8422993
Anions									
Alkalinity (PP as CaCO3)	mg/L	<0.50	8422991	<0.50	0.50	8422991	<0.50	0.50	8422991
Alkalinity (Total as CaCO3)	mg/L	370	8422991	460	0.50	8422991	460	0.50	8422991
Bicarbonate (HCO3)	mg/L	450	8422991	560	0.50	8422991	560	0.50	8422991
Carbonate (CO3)	mg/L	<0.50	8422991	<0.50	0.50	8422991	<0.50	0.50	8422991
Hydroxide (OH)	mg/L	<0.50	8422991	<0.50	0.50	8422991	<0.50	0.50	8422991
Dissolved Sulphate (SO4)	mg/L	140	8427521	110	1.0	8427521	2200 (1)	20	8427480
Dissolved Chloride (Cl)	mg/L	60	8427519	110	1.0	8427519	3.0	1.0	8427477
Nutrients									
Dissolved Nitrite (N)	mg/L	<0.010	8423525	<0.010	0.010	8423525	<0.010	0.010	8423525
Dissolved Nitrate (N)	mg/L	1.6	8423525	0.70	0.010	8423525	0.010	0.010	8423525
Elements									
Dissolved Aluminum (Al)	mg/L	<0.0030	8422814	<0.0030	0.0030	8422814	<0.0030	0.0030	8422814
Dissolved Antimony (Sb)	mg/L	<0.00060	8422814	<0.00060	0.00060	8422814	<0.00060	0.00060	8422814
Dissolved Arsenic (As)	mg/L	<0.00020	8422814	<0.00020	0.00020	8422814	0.0019	0.00020	8422814
Dissolved Barium (Ba)	mg/L	0.039	8426610	0.054	0.010	8426610	<0.010	0.010	8426610
Dissolved Beryllium (Be)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Boron (B)	mg/L	0.043	8426610	0.043	0.020	8426610	0.11	0.020	8426610
Dissolved Cadmium (Cd)	mg/L	0.000040	8422814	0.000029	0.000020	8422814	<0.000020	0.000020	8422814

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5504		PR5505			PR5506		
Sampling Date		2016/10/04 16:12		2016/10/04 16:06			2016/10/04 12:15		
COC Number		M031942		M031942			M031942		
	UNITS	MW16-8-8	QC Batch	MW16-8-19	RDL	QC Batch	MW16-4-16	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	120	8426610	130	0.30	8426610	380	0.30	8426610
Dissolved Chromium (Cr)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Cobalt (Co)	mg/L	0.00057	8422814	<0.00030	0.00030	8422814	0.00031	0.00030	8422814
Dissolved Copper (Cu)	mg/L	0.00032	8422814	<0.00020	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Iron (Fe)	mg/L	<0.060	8426610	<0.060	0.060	8426610	2.2	0.060	8426610
Dissolved Lead (Pb)	mg/L	<0.00020	8422814	<0.00020	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Lithium (Li)	mg/L	<0.020	8426610	<0.020	0.020	8426610	0.074	0.020	8426610
Dissolved Magnesium (Mg)	mg/L	60	8426610	60	0.20	8426610	180	0.20	8426610
Dissolved Manganese (Mn)	mg/L	0.12	8426610	0.0062	0.0040	8426610	0.60	0.0040	8426610
Dissolved Molybdenum (Mo)	mg/L	0.0011	8422814	0.00085	0.00020	8422814	0.0015	0.00020	8422814
Dissolved Nickel (Ni)	mg/L	0.0025	8422814	<0.00050	0.00050	8422814	<0.00050	0.00050	8422814
Dissolved Phosphorus (P)	mg/L	<0.10	8426610	<0.10	0.10	8426610	<0.10	0.10	8426610
Dissolved Potassium (K)	mg/L	5.8	8426610	5.7	0.30	8426610	8.5	0.30	8426610
Dissolved Selenium (Se)	mg/L	0.011	8422814	0.0080	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Silicon (Si)	mg/L	4.2	8426610	3.7	0.10	8426610	4.4	0.10	8426610
Dissolved Silver (Ag)	mg/L	<0.00010	8422814	<0.00010	0.00010	8422814	<0.00010	0.00010	8422814
Dissolved Sodium (Na)	mg/L	25	8426610	47	0.50	8426610	390	0.50	8426610
Dissolved Strontium (Sr)	mg/L	0.90	8426610	1.3	0.020	8426610	5.9 (1)	0.20	8426610
Dissolved Sulphur (S)	mg/L	45	8426610	29	0.20	8426610	720 (1)	2.0	8426610
Dissolved Thallium (Tl)	mg/L	<0.00020	8422814	<0.00020	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Tin (Sn)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Titanium (Ti)	mg/L	<0.0010	8422814	0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Uranium (U)	mg/L	0.011	8422814	0.0053	0.00010	8422814	0.0022	0.00010	8422814
Dissolved Vanadium (V)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Zinc (Zn)	mg/L	<0.0030	8422814	<0.0030	0.0030	8422814	<0.0030	0.0030	8422814

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5506		
Sampling Date		2016/10/04 12:15		
COC Number		M031942		
	UNITS	**MW16-4-16 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics				
Conductivity	uS/cm	4000	1.0	8422994
pH	pH	7.46	N/A	8422993
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8422991
Alkalinity (Total as CaCO3)	mg/L	460	0.50	8422991
Bicarbonate (HCO3)	mg/L	560	0.50	8422991
Carbonate (CO3)	mg/L	<0.50	0.50	8422991
Hydroxide (OH)	mg/L	<0.50	0.50	8422991

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5503		
Sampling Date		2016/10/04 15:04		
COC Number		M031942		
	UNITS	MW16-10-15	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	45	N/A	8421120
Cation Sum	meq/L	42	N/A	8421120
Hardness (CaCO3)	mg/L	1400	0.50	8422175
Ion Balance	N/A	0.94	0.010	8421119
Dissolved Nitrate (NO3)	mg/L	0.12	0.044	8421045
Nitrate plus Nitrite (N)	mg/L	0.027	0.020	8421046
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8421045
Calculated Total Dissolved Solids	mg/L	2800	10	8421121
Anions				
Alkalinity (PP as CaCO3)	mg/L	<5.0	5.0	8422991
Alkalinity (Total as CaCO3)	mg/L	380	5.0	8422991
Bicarbonate (HCO3)	mg/L	470	5.0	8422991
Carbonate (CO3)	mg/L	<5.0	5.0	8422991
Hydroxide (OH)	mg/L	<5.0	5.0	8422991
Dissolved Sulphate (SO4)	mg/L	1800 (1)	20	8427480
Dissolved Chloride (Cl)	mg/L	7.1	1.0	8427477
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8423539
Dissolved Nitrate (N)	mg/L	0.027	0.010	8423539
Lab Filtered Elements				
Dissolved Aluminum (Al)	mg/L	0.0042	0.0030	8423671
Dissolved Antimony (Sb)	mg/L	0.00079	0.00060	8423671
Dissolved Arsenic (As)	mg/L	0.0012	0.00020	8423671
Dissolved Barium (Ba)	mg/L	0.022	0.010	8426641
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8423671
Dissolved Boron (B)	mg/L	0.12	0.020	8426641
Dissolved Cadmium (Cd)	mg/L	0.00010	0.000020	8423671
Dissolved Calcium (Ca)	mg/L	320	0.30	8426641
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8423671

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5503		
Sampling Date		2016/10/04 15:04		
COC Number		M031942		
	UNITS	MW16-10-15	RDL	QC Batch
Dissolved Cobalt (Co)	mg/L	0.0043	0.00030	8423671
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8423671
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8426641
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8423671
Dissolved Lithium (Li)	mg/L	0.055	0.020	8426641
Dissolved Magnesium (Mg)	mg/L	140	0.20	8426641
Dissolved Manganese (Mn)	mg/L	1.0	0.0040	8426641
Dissolved Molybdenum (Mo)	mg/L	0.0034	0.00020	8423671
Dissolved Nickel (Ni)	mg/L	0.013	0.00050	8423671
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8426641
Dissolved Potassium (K)	mg/L	11	0.30	8426641
Dissolved Selenium (Se)	mg/L	0.00038	0.00020	8423671
Dissolved Silicon (Si)	mg/L	4.5	0.10	8426641
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8423671
Dissolved Sodium (Na)	mg/L	330	0.50	8426641
Dissolved Strontium (Sr)	mg/L	3.4	0.020	8426641
Dissolved Sulphur (S)	mg/L	650 (1)	2.0	8426641
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8423671
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8423671
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8423671
Dissolved Uranium (U)	mg/L	0.012	0.00010	8423671
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8423671
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8423671

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5499	PR5499			PR5500	PR5500		
Sampling Date		2016/10/04 10:50	2016/10/04 10:50			2016/10/04 10:10	2016/10/04 10:10		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	MW16-18-6	MW16-18-6 Lab-Dup	RDL	QC Batch	MW16-18-10	MW16-18-10 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.9	N/A	0.50	8424431	2.6	N/A	0.50	8424431
Microbiological Param.									
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	8422823	<100 (1)	N/A	100	8422823
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	8422822	<100 (1)	N/A	100	8422822
Heterotrophic Plate Count	CFU/mL	4400 (2)	4400	10	8422824	17000 (2)	18000	100	8422824
Total Coliforms DST	mpn/100mL	140 (1)	N/A	10	8422823	310 (1)	N/A	100	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	8423168	<0.050	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.050	8428234	18 (3)	N/A	1.3	8428215
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	0.0038	N/A	0.0030	8422351	<0.0030	N/A	0.0030	8422351

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5501	PR5501			PR5502	PR5502		
Sampling Date		2016/10/04 12:14	2016/10/04 12:14			2016/10/04 13:16	2016/10/04 13:16		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	MW16-4-20	MW16-4-20 Lab-Dup	RDL	QC Batch	MW16-5-11	MW16-5-11 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	5.1	N/A	0.50	8424431	2.8	N/A	0.50	8424431
Microbiological Param.									
E.Coli DST	mpn/100mL	<2.0 (1)	N/A	2.0	8422823	<100 (1)	N/A	100	8422823
Fecal Coliforms	MPN/100mL	<2.0 (1)	N/A	2.0	8422822	<100 (1)	N/A	100	8422822
Heterotrophic Plate Count	CFU/mL	550 (2)	560	2.0	8422824	44000 (2)	44000	100	8422824
Total Coliforms DST	mpn/100mL	<2.0 (1)	N/A	2.0	8422823	<100 (1)	N/A	100	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	0.96	N/A	0.050	8423168	0.062	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	1.1	N/A	0.050	8425847	7.5 (2)	N/A	0.25	8428216
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	<0.0030 (3)	<0.0030	0.0030	8422351	0.0034	N/A	0.0030	8422351

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5503	PR5503			PR5504	PR5504		
Sampling Date		2016/10/04 15:04	2016/10/04 15:04			2016/10/04 16:12	2016/10/04 16:12		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	MW16-10-15	MW16-10-15 Lab-Dup	RDL	QC Batch	MW16-8-8	MW16-8-8 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	N/A	N/A	0.50	8424431	2.8	N/A	0.50	8424431
Lab Filtered Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.2	4.1	0.50	8426109	N/A	N/A	0.50	8426109
Microbiological Param.									
E.Coli DST	mpn/100mL	<100 (1)	N/A	100	8422823	<100 (1)	N/A	100	8422823
Fecal Coliforms	MPN/100mL	100 (1)	N/A	100	8422822	<100 (1)	N/A	100	8422822
Heterotrophic Plate Count	CFU/mL	>6000 (2)	>6000	100	8422824	34000 (2)	34000	100	8422824
Total Coliforms DST	mpn/100mL	9100 (1)	N/A	100	8422823	<100 (1)	N/A	100	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	N/A	N/A	0.050	8423168	0.055	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	5.4 (3)	N/A	0.25	8428234	0.95	N/A	0.050	8428215
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	N/A	N/A	0.0030	N/A	0.0045	N/A	0.0030	8422351
Lab Filtered Nutrients									
Dissolved Ammonia (N)	mg/L	0.59	0.69	0.050	8428116	N/A	N/A	N/A	N/A
Dissolved Phosphorus (P)	mg/L	0.0035	N/A	0.0030	8423804	N/A	N/A	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5505	PR5505			PR5506	PR5506		
Sampling Date		2016/10/04 16:06	2016/10/04 16:06			2016/10/04 12:15	2016/10/04 12:15		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	MW16-8-19	MW16-8-19 Lab-Dup	RDL	QC Batch	MW16-4-16	MW16-4-16 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	1.3	N/A	0.50	8424431	5.2	N/A	0.50	8424431
Microbiological Param.									
E.Coli DST	mpn/100mL	<1.0	<1.0	1.0	8422823	<2.0 (1)	N/A	2.0	8422823
Fecal Coliforms	MPN/100mL	<1.0	<1.0	1.0	8422822	<2.0 (1)	N/A	2.0	8422822
Heterotrophic Plate Count	CFU/mL	620	610	1.0	8422824	630 (2)	670	2.0	8422824
Total Coliforms DST	mpn/100mL	27	30	1.0	8422823	<2.0 (1)	N/A	2.0	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	8423168	1.0	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.050	8428216	1.1	N/A	0.050	8425847
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	8422351	<0.0030	N/A	0.0030	8422351

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PR5499	PR5500		PR5501		PR5502	PR5503		
Sampling Date		2016/10/04 10:50	2016/10/04 10:10		2016/10/04 12:14		2016/10/04 13:16	2016/10/04 15:04		
COC Number		M031942	M031942		M031942		M031942	M031942		
	UNITS	MW16-18-6	MW16-18-10	RDL	MW16-4-20	RDL	MW16-5-11	MW16-10-15	RDL	QC Batch
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	<0.0020	<0.0020	0.0020	<0.0020	0.0020	<0.0020	N/A	0.0020	8430325
Total Mercury (Hg)	ug/L	<6.0 (1)	<6.0 (1)	6.0	<2.0 (1)	2.0	<20 (1)	<20 (1)	20	8428935
Lab Filtered Elements-Low										
Dissolved Mercury (Hg)	ug/L	N/A	N/A	N/A	N/A	N/A	N/A	<0.0020	0.0020	8431903

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PR5504			PR5505	PR5505		PR5506		
Sampling Date		2016/10/04 16:12			2016/10/04 16:06	2016/10/04 16:06		2016/10/04 12:15		
COC Number		M031942			M031942	M031942		M031942		
	UNITS	MW16-8-8	RDL	QC Batch	MW16-8-19	MW16-8-19 Lab-Dup	RDL	MW16-4-16	RDL	QC Batch
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	8430325	<0.0020	<0.0020	0.0020	<0.0020	0.0020	8430330
Total Mercury (Hg)	ug/L	<20 (1)	20	8428935	<0.10 (1)	N/A	0.10	<6.0 (1)	6.0	8428935

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.0°C

ROUTINE WATER & DISS. REGULATED METALS (WATER) Comments

Sample PR5503-01 Alkalinity @25C (pp, total), CO3,HCO3,OH: Detection limits raised due to sample matrix.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8422351	MB5	Matrix Spike [PR5501-03]	Dissolved Phosphorus (P)	2016/10/06		22 (1)	%	80 - 120
8422351	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/06		107	%	80 - 120
8422351	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/06		105	%	80 - 120
8422351	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/06	<0.0030		mg/L	
8422351	MB5	RPD [PR5501-03]	Dissolved Phosphorus (P)	2016/10/06	NC		%	20
8422814	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/06		108	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		94	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		98	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		95	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		99	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		98	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		96	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		98	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		99	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		96	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		96	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		93	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		104	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		94	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		103	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		95	%	80 - 120
8422814	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/06		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		96	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		98	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		96	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		96	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		93	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		97	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		96	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		93	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		94	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		93	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		100	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		97	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		92	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		97	%	80 - 120
8422814	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/06	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/06	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/06	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/06	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/06	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/06	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/06	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/06	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/06	<0.00020		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Molybdenum (Mo)	2016/10/06	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/06	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/06	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/06	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/06	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/06	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/06	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/06	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/06	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/06	<0.0030		mg/L	
8422814	PC5	RPD	Dissolved Aluminum (Al)	2016/10/06	NC		%	20
			Dissolved Antimony (Sb)	2016/10/06	NC		%	20
			Dissolved Arsenic (As)	2016/10/06	NC		%	20
			Dissolved Beryllium (Be)	2016/10/06	NC		%	20
			Dissolved Chromium (Cr)	2016/10/06	NC		%	20
			Dissolved Cobalt (Co)	2016/10/06	NC		%	20
			Dissolved Copper (Cu)	2016/10/06	NC		%	20
			Dissolved Lead (Pb)	2016/10/06	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/06	NC		%	20
			Dissolved Nickel (Ni)	2016/10/06	NC		%	20
			Dissolved Selenium (Se)	2016/10/06	NC		%	20
			Dissolved Silver (Ag)	2016/10/06	NC		%	20
			Dissolved Thallium (Tl)	2016/10/06	NC		%	20
			Dissolved Tin (Sn)	2016/10/06	NC		%	20
			Dissolved Titanium (Ti)	2016/10/06	NC		%	20
			Dissolved Uranium (U)	2016/10/06	0.56		%	20
			Dissolved Vanadium (V)	2016/10/06	NC		%	20
			Dissolved Zinc (Zn)	2016/10/06	NC		%	20
8422822	RP0	Method Blank	Fecal Coliforms	2016/10/06	<1.0		MPN/10	
8422822	RP0	RPD [PR5505-09]	Fecal Coliforms	2016/10/06	NC		%	N/A
8422823	AP1	Method Blank	E.Coli DST	2016/10/06	<1.0		mpn/100	
			Total Coliforms DST	2016/10/06	<1.0		mpn/100	
8422823	AP1	RPD [PR5505-09]	E.Coli DST	2016/10/06	NC		%	N/A
			Total Coliforms DST	2016/10/06	11		%	N/A
8422824	AP1	Method Blank	Heterotrophic Plate Count	2016/10/07	<1.0		CFU/mL	
8422824	AP1	RPD [PR5499-09]	Heterotrophic Plate Count	2016/10/07	0.90		%	N/A
8422824	AP1	RPD [PR5500-09]	Heterotrophic Plate Count	2016/10/07	8.7		%	N/A
8422824	AP1	RPD [PR5501-09]	Heterotrophic Plate Count	2016/10/07	1.8		%	N/A
8422824	AP1	RPD [PR5502-09]	Heterotrophic Plate Count	2016/10/07	1.6		%	N/A
8422824	AP1	RPD [PR5503-09]	Heterotrophic Plate Count	2016/10/07	NC		%	N/A
8422824	AP1	RPD [PR5504-09]	Heterotrophic Plate Count	2016/10/07	1.2		%	N/A
8422824	AP1	RPD [PR5505-09]	Heterotrophic Plate Count	2016/10/07	1.6		%	N/A
8422824	AP1	RPD [PR5506-09]	Heterotrophic Plate Count	2016/10/07	7.4		%	N/A
8422901	VP4	Matrix Spike	O-TERPHENYL (sur.)	2016/10/08		102	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	50 - 130
8422901	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/10/08		103	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	70 - 130
8422901	VP4	Method Blank	O-TERPHENYL (sur.)	2016/10/08		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08	<0.10		mg/L	
8422901	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/08	NC		%	40
8422991	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/05		98	%	80 - 120
8422991	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/05	<0.50		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Alkalinity (Total as CaCO3)	2016/10/05	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/05	<0.50		mg/L	
			Carbonate (CO3)	2016/10/05	<0.50		mg/L	
			Hydroxide (OH)	2016/10/05	<0.50		mg/L	
8422991	IK0	RPD [PR5506-01]	Alkalinity (PP as CaCO3)	2016/10/05	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/05	0.13		%	20
			Bicarbonate (HCO3)	2016/10/05	0.13		%	20
			Carbonate (CO3)	2016/10/05	NC		%	20
			Hydroxide (OH)	2016/10/05	NC		%	20
8422993	IK0	Spiked Blank	pH	2016/10/05		101	%	97 - 103
8422993	IK0	RPD [PR5506-01]	pH	2016/10/05	0.17		%	N/A
8422994	IK0	Spiked Blank	Conductivity	2016/10/05		99	%	90 - 110
8422994	IK0	Method Blank	Conductivity	2016/10/05	<1.0		uS/cm	
8422994	IK0	RPD [PR5506-01]	Conductivity	2016/10/05	0.25		%	20
8423168	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/10/05		93	%	80 - 120
8423168	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		94	%	80 - 120
8423168	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423168	MB5	RPD	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8423525	CT6	Matrix Spike	Dissolved Nitrite (N)	2016/10/06		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		103	%	80 - 120
8423525	CT6	Spiked Blank	Dissolved Nitrite (N)	2016/10/06		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		101	%	80 - 120
8423525	CT6	Method Blank	Dissolved Nitrite (N)	2016/10/06	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/06	<0.010		mg/L	
8423525	CT6	RPD	Dissolved Nitrite (N)	2016/10/06	NC		%	20
			Dissolved Nitrate (N)	2016/10/06	NC		%	20
8423539	CT6	Matrix Spike	Dissolved Nitrite (N)	2016/10/06		NC	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		105	%	80 - 120
8423539	CT6	Spiked Blank	Dissolved Nitrite (N)	2016/10/06		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		101	%	80 - 120
8423539	CT6	Method Blank	Dissolved Nitrite (N)	2016/10/06	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/06	<0.010		mg/L	
8423539	CT6	RPD	Dissolved Nitrite (N)	2016/10/06	2.0		%	20
			Dissolved Nitrate (N)	2016/10/06	2.5		%	20
8423671	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/06		93	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		95	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		96	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		83	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		96	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		93	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		91	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		90	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		103	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		92	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		97	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		91	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		90	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		110	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		98	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		90	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		97	%	80 - 120

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Client Project #: 110773396
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Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Zinc (Zn)	2016/10/06		NC	%	80 - 120
8423671	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/06		128 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		86	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		100	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		100	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		98	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		99	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		96	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		95	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		91	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		104	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		100	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		93	%	80 - 120
8423671	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/06	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/06	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/06	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/06	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/06	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/06	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/06	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/06	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/06	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/06	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/06	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/06	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/06	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/06	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/06	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/06	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/06	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/06	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/06	<0.0030		mg/L	
8423671	PC5	RPD	Dissolved Aluminum (Al)	2016/10/06	NC		%	20
			Dissolved Antimony (Sb)	2016/10/06	NC		%	20
			Dissolved Arsenic (As)	2016/10/06	4.4		%	20
			Dissolved Beryllium (Be)	2016/10/06	NC		%	20
			Dissolved Chromium (Cr)	2016/10/06	NC		%	20
			Dissolved Cobalt (Co)	2016/10/06	3.4		%	20
			Dissolved Copper (Cu)	2016/10/06	2.6		%	20
			Dissolved Lead (Pb)	2016/10/06	1.7		%	20
			Dissolved Molybdenum (Mo)	2016/10/06	0.33		%	20
			Dissolved Nickel (Ni)	2016/10/06	0.66		%	20
			Dissolved Selenium (Se)	2016/10/06	4.5		%	20
			Dissolved Silver (Ag)	2016/10/06	NC		%	20
			Dissolved Thallium (Tl)	2016/10/06	NC		%	20

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Client Project #: 110773396
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/10/06	NC		%	20
			Dissolved Titanium (Ti)	2016/10/06	NC		%	20
			Dissolved Uranium (U)	2016/10/06	1.6		%	20
			Dissolved Vanadium (V)	2016/10/06	NC		%	20
			Dissolved Zinc (Zn)	2016/10/06	4.1		%	20
8423804	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/09		97	%	80 - 120
8423804	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/09		94	%	80 - 120
8423804	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/09		93	%	80 - 120
8423804	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/09	0.0031, RDL=0.0030		mg/L	
8423804	RM9	RPD	Dissolved Phosphorus (P)	2016/10/09	NC		%	20
8424431	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/06		NC	%	80 - 120
8424431	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/06		103	%	80 - 120
8424431	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/06	<0.50		mg/L	
8424431	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/06	1.7		%	20
8424717	MB5	Matrix Spike	Orthophosphate (P)	2016/10/06		97	%	80 - 120
8424717	MB5	Spiked Blank	Orthophosphate (P)	2016/10/06		100	%	80 - 120
8424717	MB5	Method Blank	Orthophosphate (P)	2016/10/06	<0.0030		mg/L	
8424717	MB5	RPD	Orthophosphate (P)	2016/10/06	NC		%	20
8425847	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/07		84	%	80 - 120
8425847	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/07		85	%	80 - 120
8425847	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/07		89	%	80 - 120
8425847	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/07	0.071, RDL=0.050		mg/L	
8425847	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/07	NC		%	20
8426109	MUK	Matrix Spike [PR5503-01]	Dissolved Organic Carbon (C)	2016/10/07		104	%	80 - 120
8426109	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/07		102	%	80 - 120
8426109	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/07	<0.50		mg/L	
8426109	MUK	RPD [PR5503-01]	Dissolved Organic Carbon (C)	2016/10/07	0.86		%	20
8426610	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/08		83	%	80 - 120
			Dissolved Boron (B)	2016/10/08		82	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		83	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		87	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		88	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		84	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		88	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		97	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		85	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		94	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		80	%	80 - 120
8426610	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/08		85	%	80 - 120
			Dissolved Boron (B)	2016/10/08		82	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		91	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		88	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		89	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		91	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		87	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		89	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		97	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		86	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		96	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Strontium (Sr)	2016/10/08		83	%	80 - 120
8426610	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/08	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/08	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/08	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/08	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/08	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/08	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/08	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/08	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/08	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/08	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/08	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/08	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/08	<0.20		mg/L	
8426610	JHC	RPD	Dissolved Barium (Ba)	2016/10/08	2.6		%	20
			Dissolved Boron (B)	2016/10/08	NC		%	20
			Dissolved Calcium (Ca)	2016/10/08	2.9		%	20
			Dissolved Iron (Fe)	2016/10/08	2.9		%	20
			Dissolved Lithium (Li)	2016/10/08	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/08	2.2		%	20
			Dissolved Manganese (Mn)	2016/10/08	3.1		%	20
			Dissolved Phosphorus (P)	2016/10/08	NC		%	20
			Dissolved Potassium (K)	2016/10/08	0.48		%	20
			Dissolved Silicon (Si)	2016/10/08	2.8		%	20
			Dissolved Sodium (Na)	2016/10/08	1.3		%	20
			Dissolved Strontium (Sr)	2016/10/08	2.7		%	20
			Dissolved Sulphur (S)	2016/10/08	2.7		%	20
8426625	MAP	Matrix Spike [PR5502-04]	Dissolved Barium (Ba)	2016/10/08		86	%	80 - 120
			Dissolved Boron (B)	2016/10/08		83	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		94	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		85	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		89	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		92	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		93	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		89	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		91	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		84	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		85	%	80 - 120
8426625	MAP	Spiked Blank	Dissolved Barium (Ba)	2016/10/08		89	%	80 - 120
			Dissolved Boron (B)	2016/10/08		85	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		97	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		87	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		94	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		95	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		93	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		89	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		90	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		90	%	80 - 120
8426625	MAP	Method Blank	Dissolved Barium (Ba)	2016/10/08	<0.010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Boron (B)	2016/10/08	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/08	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/08	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/08	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/08	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/08	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/08	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/08	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/08	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/08	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/08	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/08	<0.20		mg/L	
8426625	MAP	RPD [PR5502-04]	Dissolved Barium (Ba)	2016/10/08	0.16		%	20
			Dissolved Boron (B)	2016/10/08	NC		%	20
			Dissolved Calcium (Ca)	2016/10/08	0.21		%	20
			Dissolved Iron (Fe)	2016/10/08	NC		%	20
			Dissolved Lithium (Li)	2016/10/08	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/08	0.68		%	20
			Dissolved Manganese (Mn)	2016/10/08	0.20		%	20
			Dissolved Phosphorus (P)	2016/10/08	NC		%	20
			Dissolved Potassium (K)	2016/10/08	0.10		%	20
			Dissolved Silicon (Si)	2016/10/08	0.54		%	20
			Dissolved Sodium (Na)	2016/10/08	0.29		%	20
			Dissolved Strontium (Sr)	2016/10/08	0.20		%	20
			Dissolved Sulphur (S)	2016/10/08	0.74		%	20
8426641	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/08		82	%	80 - 120
			Dissolved Boron (B)	2016/10/08		84	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		88	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		87	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		NC	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		NC	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		95	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		NC	%	80 - 120
8426641	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/07		91	%	80 - 120
			Dissolved Boron (B)	2016/10/07		87	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/07		97	%	80 - 120
			Dissolved Iron (Fe)	2016/10/07		94	%	80 - 120
			Dissolved Lithium (Li)	2016/10/07		91	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/07		95	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/07		93	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/07		94	%	80 - 120
			Dissolved Potassium (K)	2016/10/07		101	%	80 - 120
			Dissolved Silicon (Si)	2016/10/07		91	%	80 - 120
			Dissolved Sodium (Na)	2016/10/07		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/07		88	%	80 - 120
8426641	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/07	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/07	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/07	<0.30		mg/L	

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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Iron (Fe)	2016/10/07	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/07	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/07	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/07	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/07	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/07	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/07	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/07	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/07	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/07	<0.20		mg/L	
8426641	JHC	RPD	Dissolved Calcium (Ca)	2016/10/07	0.18		%	20
			Dissolved Iron (Fe)	2016/10/07	6.5		%	20
			Dissolved Magnesium (Mg)	2016/10/07	0.23		%	20
			Dissolved Manganese (Mn)	2016/10/07	0.34		%	20
			Dissolved Potassium (K)	2016/10/07	1.5		%	20
			Dissolved Sodium (Na)	2016/10/07	3.3		%	20
8427477	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/08		NC	%	80 - 120
8427477	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/08		104	%	80 - 120
8427477	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/08	1.5, RDL=1.0		mg/L	
8427477	ZI	RPD	Dissolved Chloride (Cl)	2016/10/08	1.0		%	20
8427480	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/08		NC	%	80 - 120
8427480	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/08		102	%	80 - 120
8427480	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/08	<1.0		mg/L	
8427480	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/08	2.2		%	20
8427519	ZI	Matrix Spike [PR5499-01]	Dissolved Chloride (Cl)	2016/10/08		NC	%	80 - 120
8427519	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/08		106	%	80 - 120
8427519	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/08	1.8, RDL=1.0		mg/L	
8427519	ZI	RPD [PR5499-01]	Dissolved Chloride (Cl)	2016/10/08	4.9		%	20
8427521	ZI	Matrix Spike [PR5499-01]	Dissolved Sulphate (SO4)	2016/10/08		NC	%	80 - 120
8427521	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/08		101	%	80 - 120
8427521	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/08	<1.0		mg/L	
8427521	ZI	RPD [PR5499-01]	Dissolved Sulphate (SO4)	2016/10/08	0.75		%	20
8428043	RSU	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/12		97	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/12		94	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/12		95	%	70 - 130
			Benzene	2016/10/12		94	%	70 - 130
			Toluene	2016/10/12		88	%	70 - 130
			Ethylbenzene	2016/10/12		98	%	70 - 130
			m & p-Xylene	2016/10/12		91	%	70 - 130
			o-Xylene	2016/10/12		94	%	70 - 130
			F1 (C6-C10)	2016/10/12		105	%	70 - 130
8428043	RSU	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/12		98	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/12		96	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/12		93	%	70 - 130
			Benzene	2016/10/12		95	%	70 - 130
			Toluene	2016/10/12		89	%	70 - 130
			Ethylbenzene	2016/10/12		101	%	70 - 130
			m & p-Xylene	2016/10/12		93	%	70 - 130
			o-Xylene	2016/10/12		95	%	70 - 130
			F1 (C6-C10)	2016/10/12		107	%	70 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428043	RSU	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/12		106	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/12		101	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/12		98	%	70 - 130
			Benzene	2016/10/12	<0.00040		mg/L	
			Toluene	2016/10/12	<0.00040		mg/L	
			Ethylbenzene	2016/10/12	<0.00040		mg/L	
			m & p-Xylene	2016/10/12	<0.00080		mg/L	
			o-Xylene	2016/10/12	<0.00040		mg/L	
			Xylenes (Total)	2016/10/12	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/12	<0.10		mg/L	
			F1 (C6-C10)	2016/10/12	<0.10		mg/L	
8428043	RSU	RPD	Benzene	2016/10/12	NC		%	40
			Toluene	2016/10/12	NC		%	40
			Ethylbenzene	2016/10/12	NC		%	40
			m & p-Xylene	2016/10/12	NC		%	40
			o-Xylene	2016/10/12	NC		%	40
			Xylenes (Total)	2016/10/12	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/12	NC		%	40
			F1 (C6-C10)	2016/10/12	NC		%	40
8428116	RM9	Matrix Spike [PR5503-01]	Dissolved Ammonia (N)	2016/10/09		NC	%	80 - 120
8428116	RM9	Spiked Blank	Dissolved Ammonia (N)	2016/10/09		101	%	80 - 120
8428116	RM9	Method Blank	Dissolved Ammonia (N)	2016/10/09	<0.050		mg/L	
8428116	RM9	RPD [PR5503-01]	Dissolved Ammonia (N)	2016/10/09	16		%	20
8428215	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/12		NC	%	80 - 120
8428215	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/12		94	%	N/A
8428215	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/12		93	%	80 - 120
8428215	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/12	<0.050		mg/L	
8428215	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/12	9.5		%	20
8428216	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/12		85	%	80 - 120
8428216	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/12		90	%	80 - 120
8428216	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/12		87	%	80 - 120
8428216	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/12	<0.050		mg/L	
8428216	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/12	NC		%	20
8428234	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/11		86	%	80 - 120
8428234	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/11		96	%	80 - 120
8428234	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/11		92	%	80 - 120
8428234	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/11	<0.050		mg/L	
8428234	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/11	NC		%	20
8428935	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/11		114	%	80 - 120
8428935	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/11		108	%	80 - 120
8428935	RK3	Method Blank	Total Mercury (Hg)	2016/10/11	<0.0020		ug/L	
8428935	RK3	RPD	Total Mercury (Hg)	2016/10/11	NC		%	20
8429487	YU	Spiked Blank	pH	2016/10/11		100	%	97 - 103
8429487	YU	RPD [PR5503-01]	pH	2016/10/11	0.39		%	N/A
8429611	FM0	Spiked Blank	Conductivity	2016/10/11		100	%	90 - 110
8429611	FM0	Method Blank	Conductivity	2016/10/11	1.4, RDL=1.0		uS/cm	
8429611	FM0	RPD	Conductivity	2016/10/11	2.1		%	20
8430325	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/12		112	%	80 - 120
8430325	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/12		98	%	80 - 120
8430325	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/12	<0.0020		ug/L	
8430325	RK3	RPD	Dissolved Mercury (Hg)	2016/10/12	NC		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8430330	RK3	Matrix Spike [PR5506-06]	Dissolved Mercury (Hg)	2016/10/12		103	%	80 - 120
8430330	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/12		96	%	80 - 120
8430330	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/12	<0.0020		ug/L	
8430330	RK3	RPD [PR5505-06]	Dissolved Mercury (Hg)	2016/10/12	NC		%	20
8431903	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/13		101	%	80 - 120
8431903	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/13		110	%	80 - 120
8431903	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/13	<0.0020		ug/L	
8431903	RK3	RPD	Dissolved Mercury (Hg)	2016/10/13	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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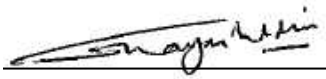
Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

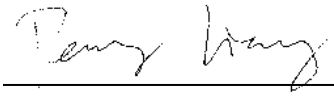
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics



Harry (Peng) Liang, Senior Analyst

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam
A Bureau Veritas Group Company

Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD M 031942

Page 1 of 1

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Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd	Company:	Quotation #:	☑ 5 - 7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112St Edmonton AB, T5K 2L6	Address:	Project #: 110773396	Rush TAT (Surcharges will be applied)
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Email: Dylan.King@stantec.com	Email:	Site #:	Date Required:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D. Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	8	7	6
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Regulatory Criteria

☐ AT1/CCME
☑ Drinking Water
☐ Saskatchewan
☐ D50 (Drilling Waste)
☐ Other:

Special Instructions

please filter and preserve dissolved parameters for MW16-10-15. Not field filtered due to turbidity.

Submitted same day as sampled.

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Diss ☒ Tot ☐	Mercury Dissolved ☒ Total ☐	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic Plate Count	HOLD - DO NOT ANALYZE
1	MW16-16-6		2016/10/04	10:50	W	13		✓		✓	✓			7	6	7	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-18-10			10:10										7	6	6										
3	MW16-4-20			12:14										7	8	7										
4	MW16-5-11			13:16										7	8	8										
5	MW16-10-15			15:04										8	7	8										
6	MW16-8-4			16:12										8	8	8										
7	MW16-8-19			16:06										8	7	7										
8	MW16-4-16			12:15										8	7	6										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
Dale Nisbet	2016/10/04	18:06	Relinquished by NATIBE BLANDUCCI	2016/10/04	13:07

04-Oct-16 18:07
Wendy Sears
B687243
NB6 INS-0001

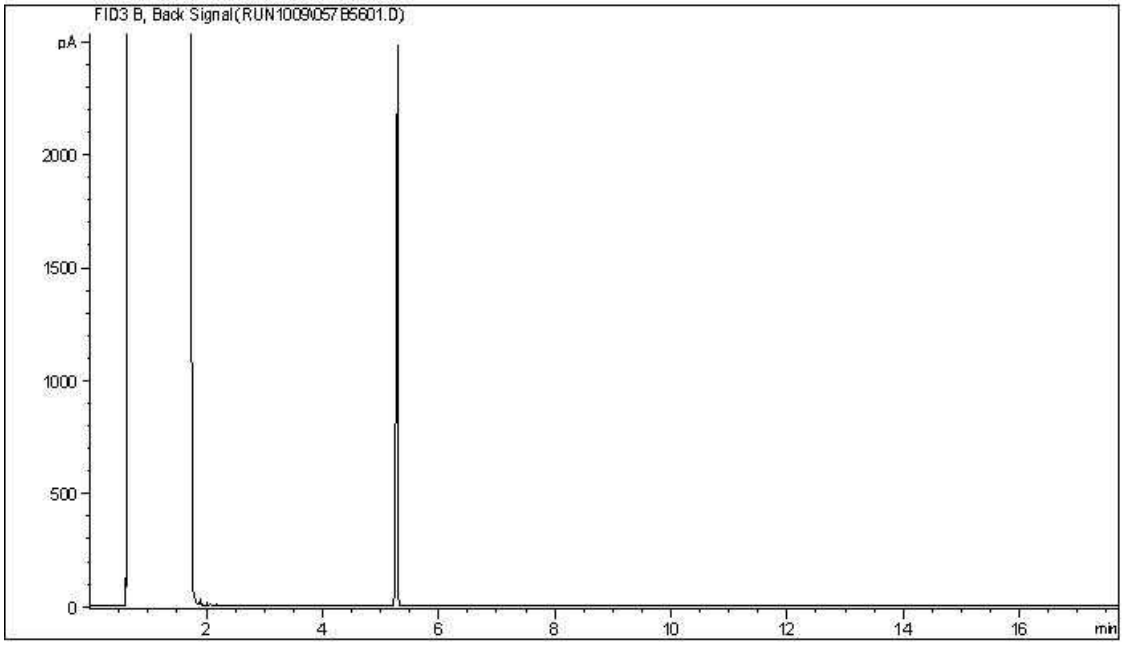
AB FCD-00331/6

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5499

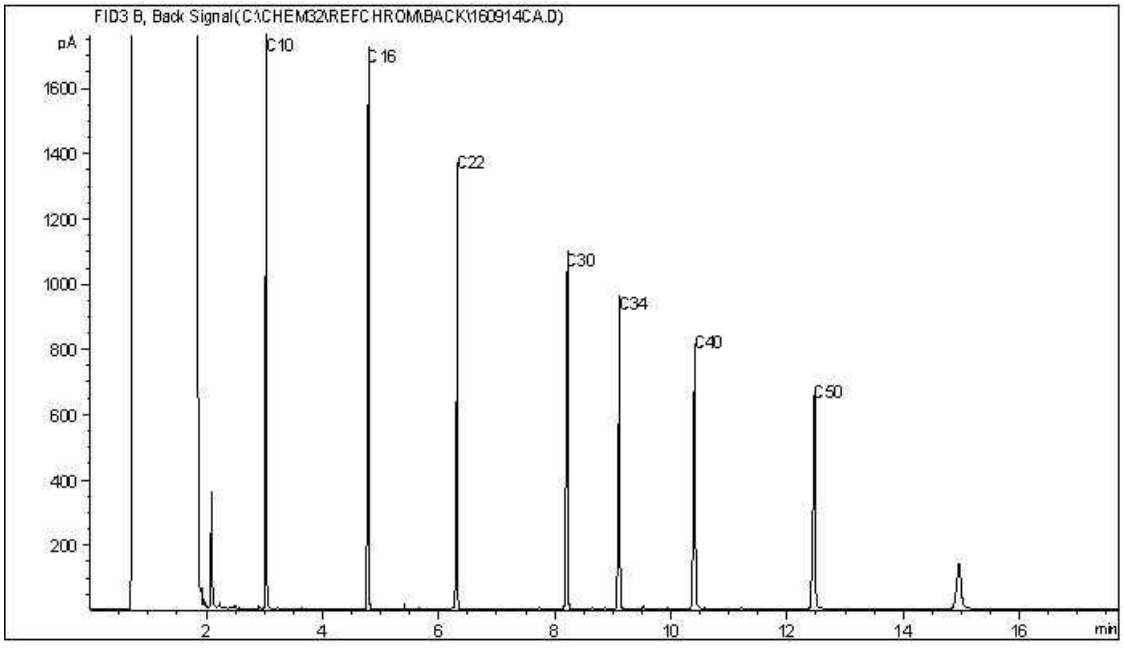
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-18-6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

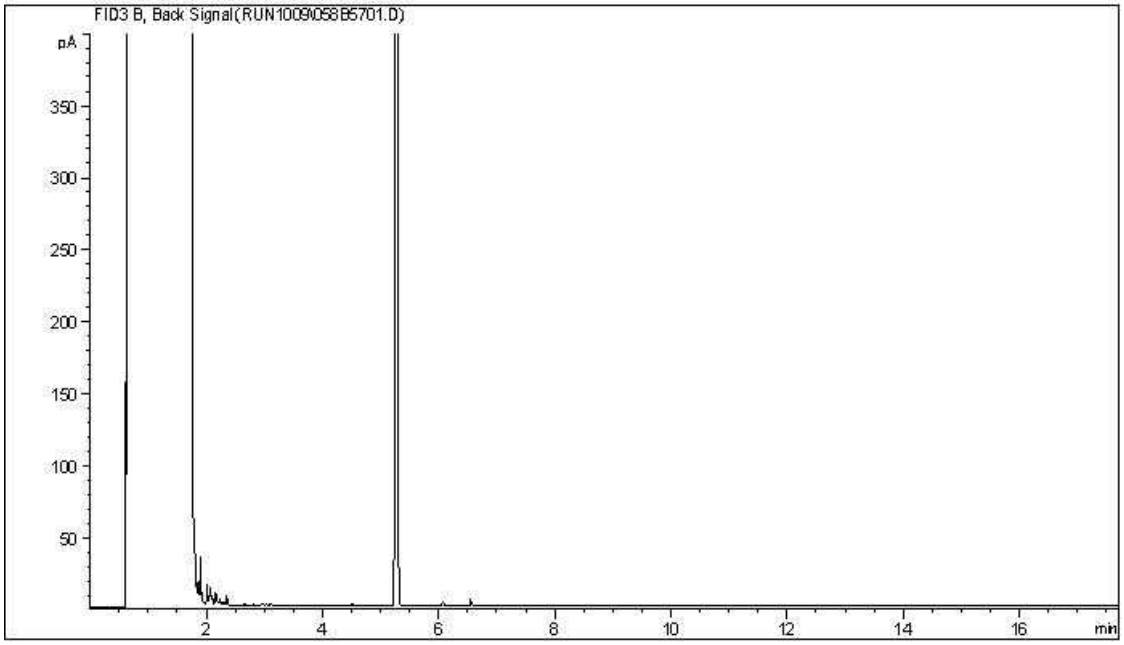
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5500

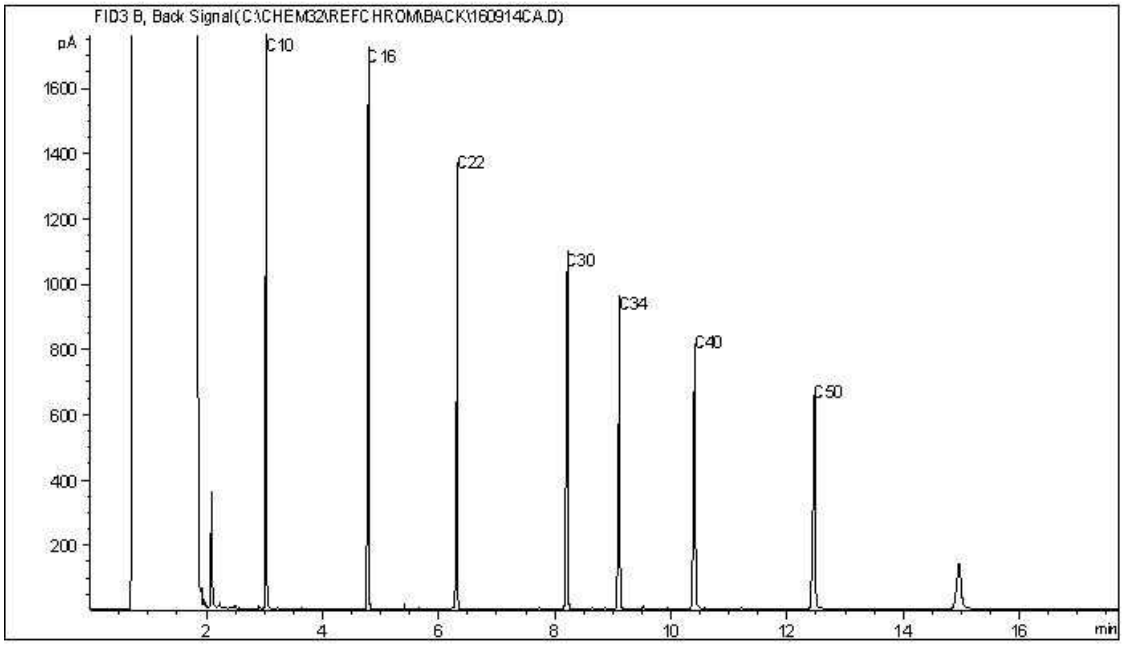
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-18-10

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

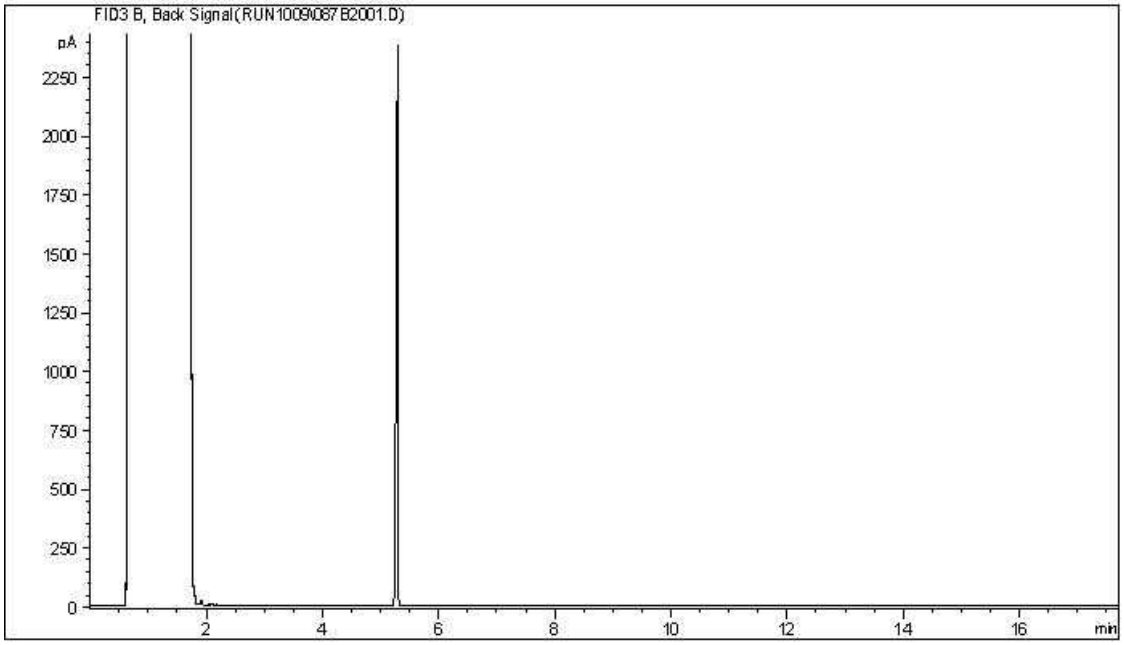
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5501

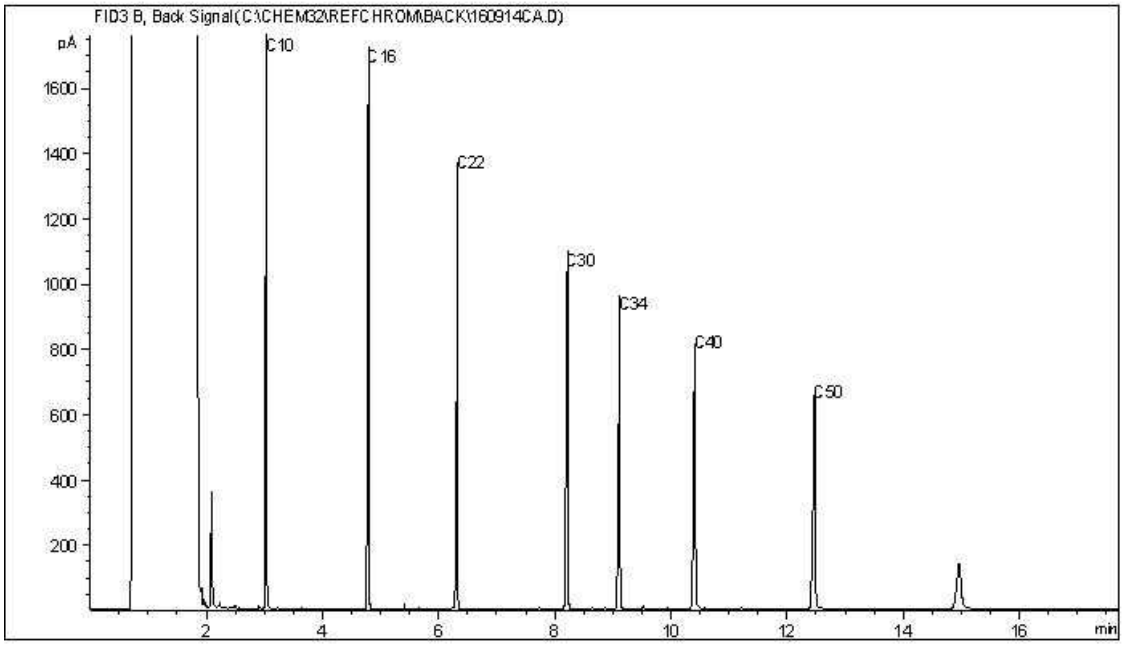
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-4-20

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

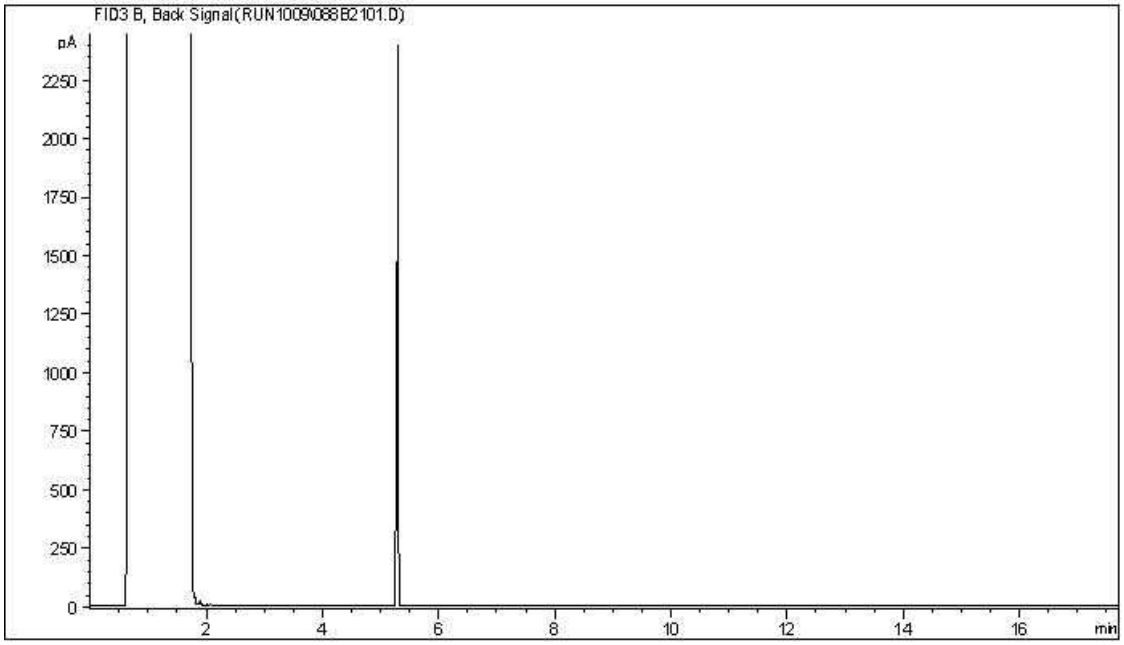
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5502

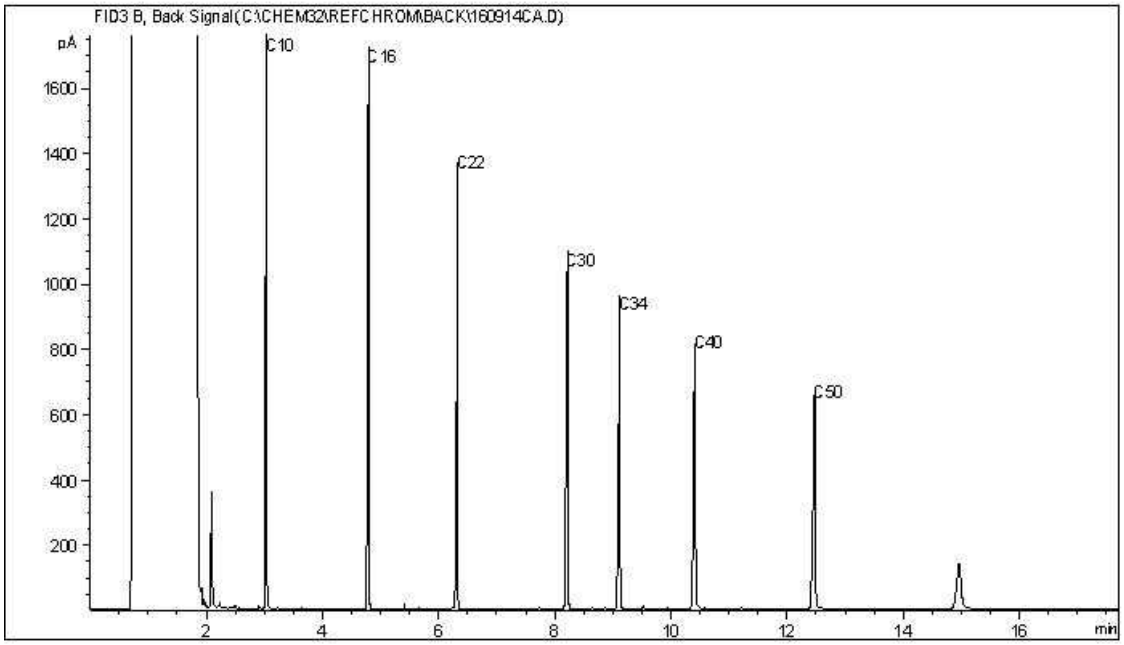
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-5-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

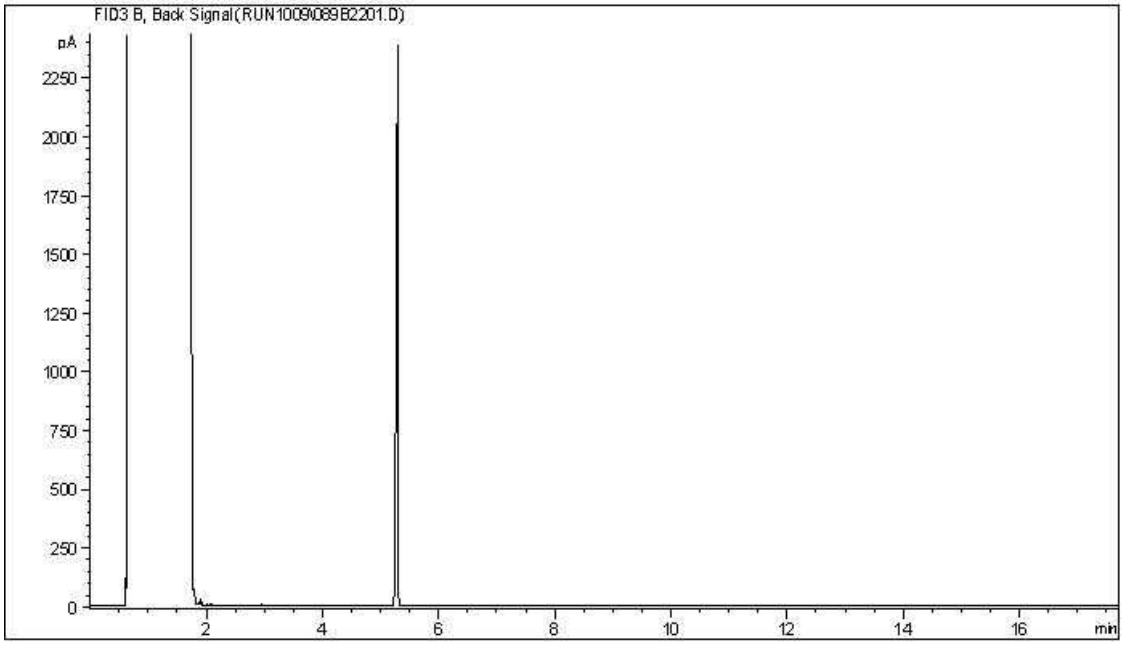
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5503

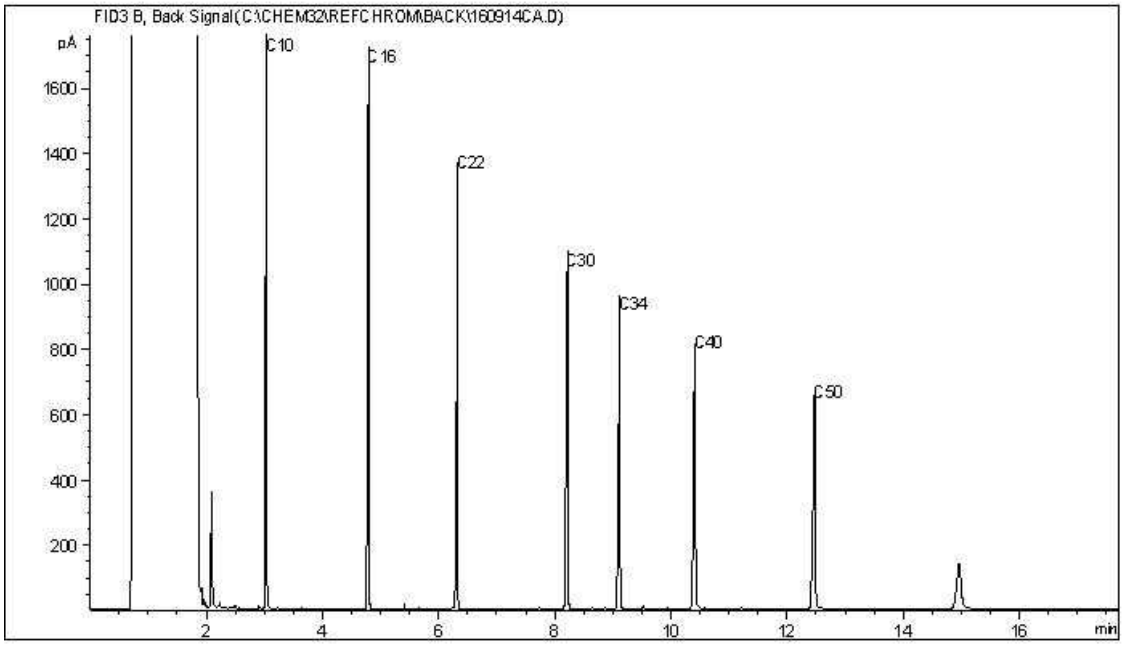
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-10-15

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

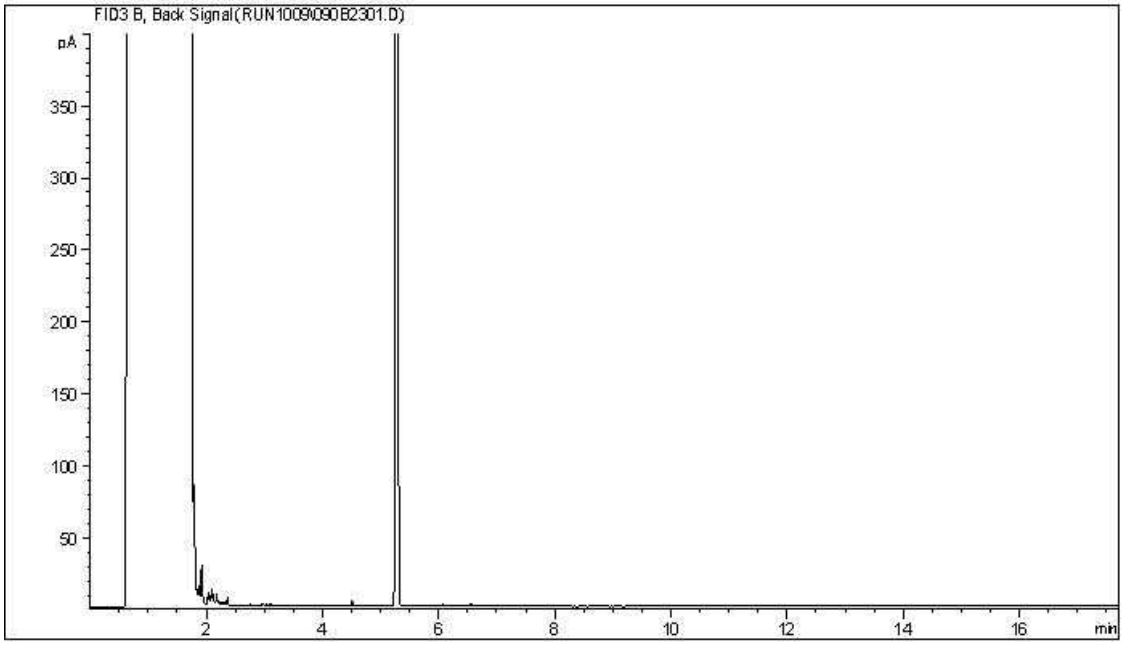
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5504

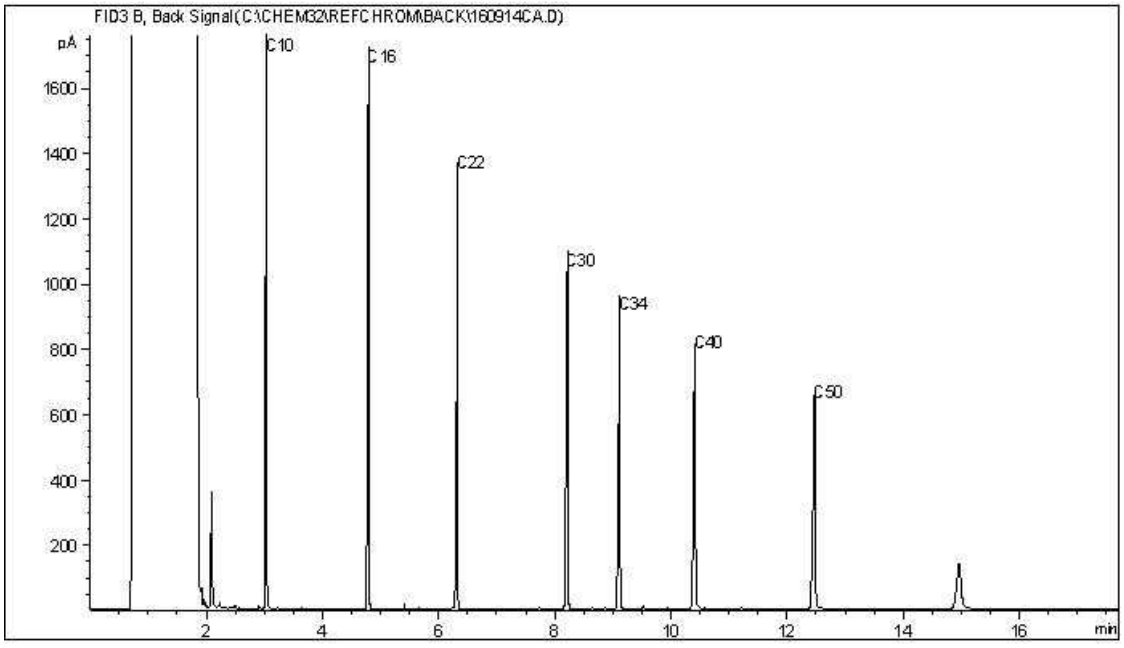
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-8-8

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

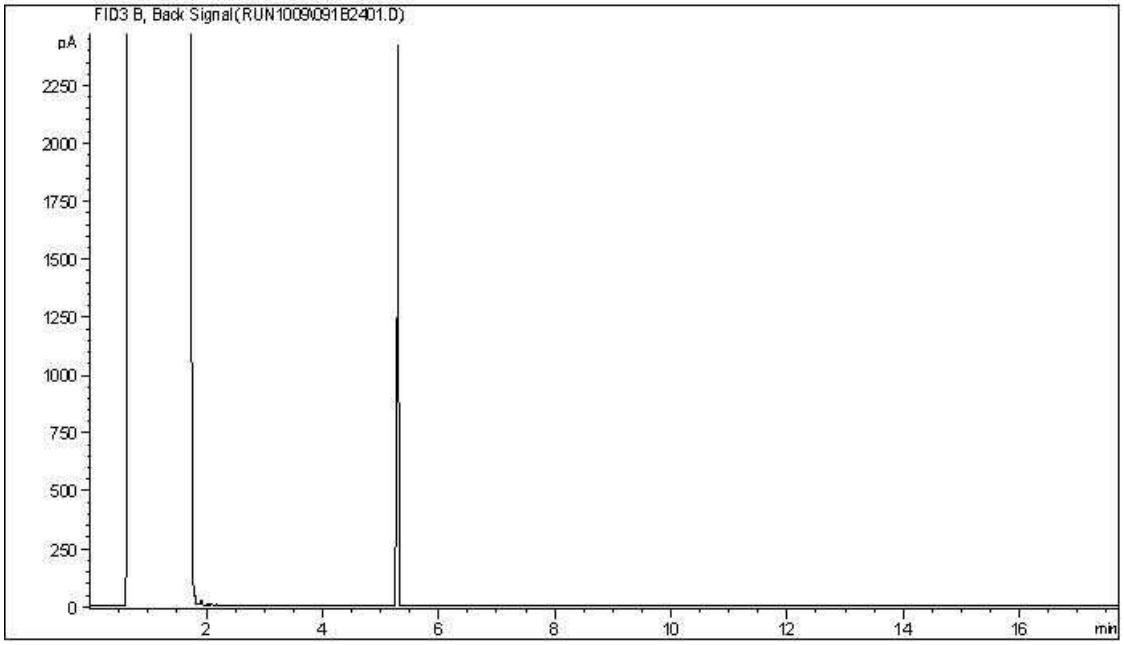
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5505

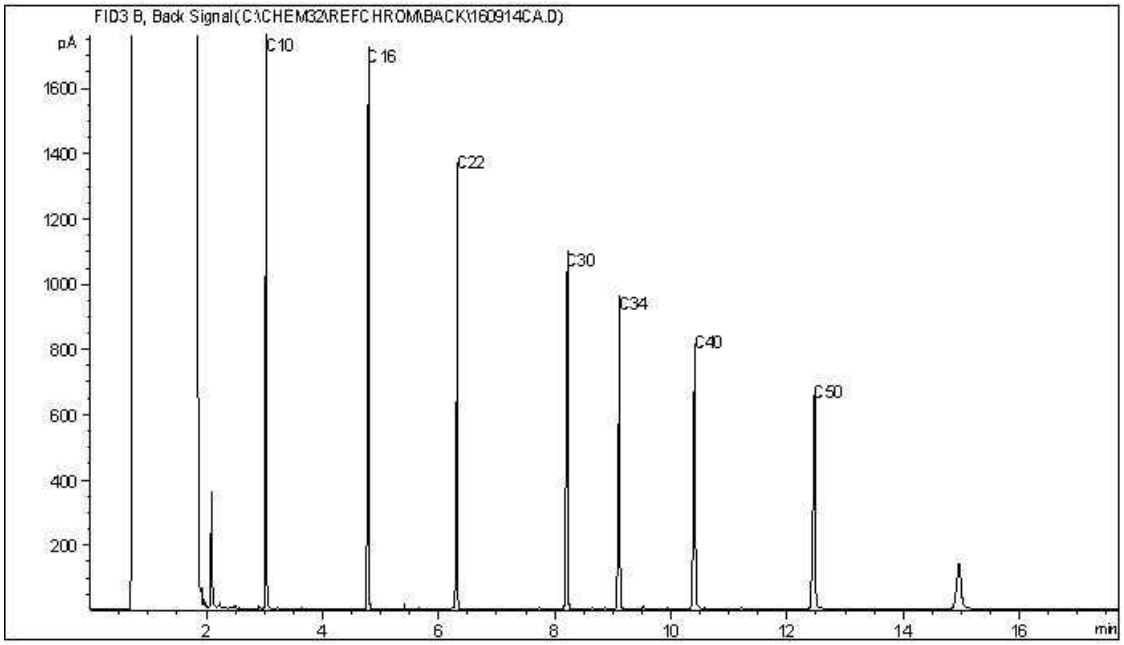
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-8-19

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

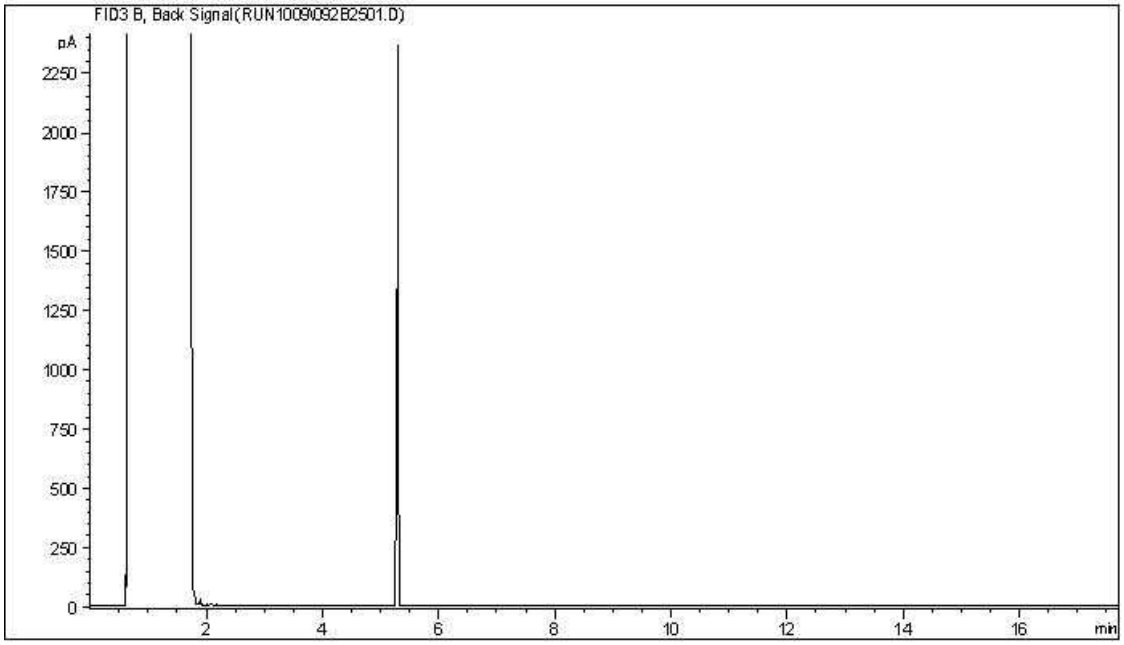
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5506

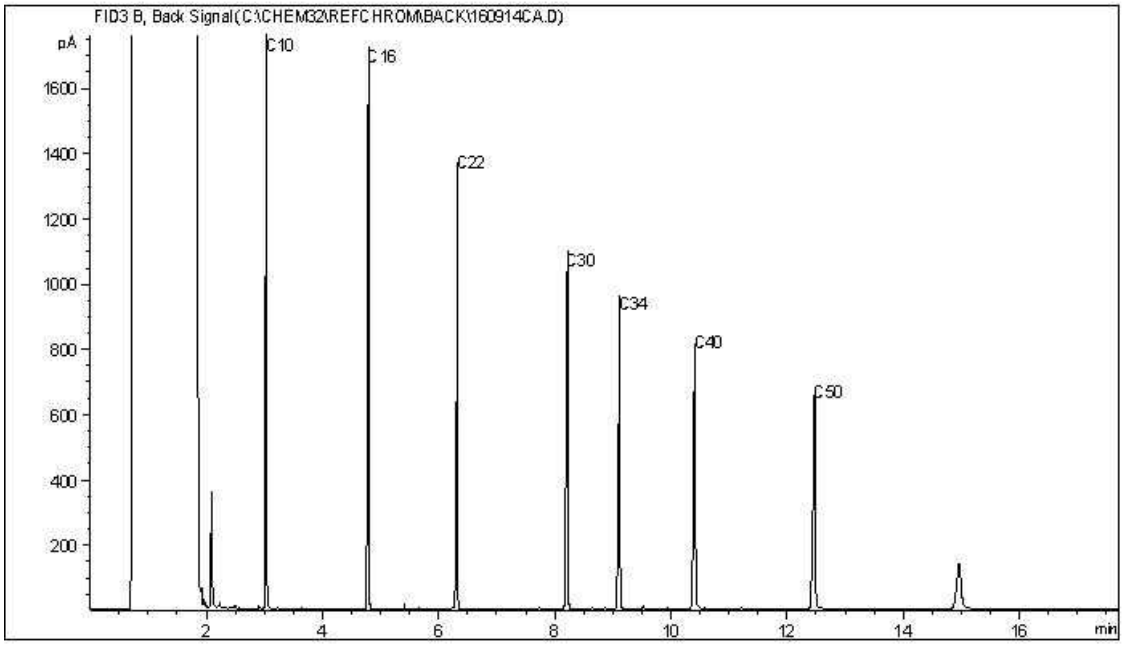
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-4-16

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031946

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/18
Report #: R2284237
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B688395
Received: 2016/10/06, 18:35

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2016/10/11	AB SOP-00005	SM 22 2320 B m
Chloride by Automated Colourimetry	2	N/A	2016/10/14	AB SOP-00020	SM 22-4500-Cl G m
Conductivity @25C	2	N/A	2016/10/11	AB SOP-00005	SM 22 2510 B m
Hardness	2	N/A	2016/10/13	AB WI-00065	Auto Calc
Mercury-Low Level-Dissolved-Lab Filtered	2	2016/10/13	2016/10/13	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	2	2016/10/17	2016/10/18	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP-Dissolved-Lab Filtered	2	N/A	2016/10/12	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS-Dissolved-Lab Filtered	2	N/A	2016/10/11	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	2	N/A	2016/10/12	AB WI-00065	Auto Calc
Sum of cations, anions	2	N/A	2016/10/13	AB WI-00065	Auto Calc
Nitrate and Nitrite	2	N/A	2016/10/12	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	2	N/A	2016/10/12	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	2	N/A	2016/10/11	AB SOP-00023	SM 22 4110 B m
pH @25°C	2	N/A	2016/10/11	AB SOP-00005	SM 22 4500-H+B m
Sulphate by Automated Colourimetry	2	N/A	2016/10/14	AB SOP-00018	SM 22 4500-SO4 E m
Total Dissolved Solids (Calculated)	2	N/A	2016/10/14	AB WI-00065	Auto Calc

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PS2812	PS2812			PS2813		
Sampling Date		2016/10/06 10:10	2016/10/06 10:10			2016/10/06 16:56		
COC Number		M031946	M031946			M031946		
	UNITS	MW16-17-5	MW16-17-5 Lab-Dup	RDL	QC Batch	MW16-12-3	RDL	QC Batch
Calculated Parameters								
Anion Sum	meq/L	110	N/A	N/A	8425566	33	N/A	8425566
Cation Sum	meq/L	100	N/A	N/A	8425566	31	N/A	8425566
Hardness (CaCO3)	mg/L	3500	N/A	0.50	8425564	1300	0.50	8425564
Ion Balance	N/A	0.93	N/A	0.010	8425565	0.94	0.010	8425565
Dissolved Nitrate (NO3)	mg/L	5.0	N/A	0.044	8425549	1.5	0.044	8425549
Nitrate plus Nitrite (N)	mg/L	1.3	N/A	0.020	8425550	0.34	0.020	8425550
Dissolved Nitrite (NO2)	mg/L	0.55	N/A	0.033	8425549	<0.033	0.033	8425549
Calculated Total Dissolved Solids	mg/L	6900	N/A	10	8425570	1900	10	8425570
Misc. Inorganics								
Conductivity	uS/cm	6900	N/A	1.0	8428919	2600	1.0	8428919
pH	pH	7.81	N/A	N/A	8428920	7.97	N/A	8428920
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8428917	<0.50	0.50	8428917
Alkalinity (Total as CaCO3)	mg/L	520	N/A	0.50	8428917	410	0.50	8428917
Bicarbonate (HCO3)	mg/L	640	N/A	0.50	8428917	510	0.50	8428917
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8428917	<0.50	0.50	8428917
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8428917	<0.50	0.50	8428917
Dissolved Sulphate (SO4)	mg/L	4800 (1)	N/A	50	8433413	900 (1)	10	8433413
Dissolved Chloride (Cl)	mg/L	8.7	N/A	1.0	8433409	230 (1)	2.0	8433409
Nutrients								
Dissolved Nitrite (N)	mg/L	0.17	0.17	0.010	8428824	<0.010	0.010	8428827
Dissolved Nitrate (N)	mg/L	1.1	1.1	0.010	8428824	0.34	0.010	8428827
Lab Filtered Elements								
Dissolved Aluminum (Al)	mg/L	0.0039	N/A	0.0030	8428460	0.0070	0.0030	8428460
Dissolved Antimony (Sb)	mg/L	0.00062	N/A	0.00060	8428460	<0.00060	0.00060	8428460
Dissolved Arsenic (As)	mg/L	0.00053	N/A	0.00020	8428460	0.00092	0.00020	8428460
Dissolved Barium (Ba)	mg/L	0.041	N/A	0.010	8431017	0.12	0.010	8431036
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Boron (B)	mg/L	0.12	N/A	0.020	8431017	0.051	0.020	8431036

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PS2812	PS2812			PS2813		
Sampling Date		2016/10/06 10:10	2016/10/06 10:10			2016/10/06 16:56		
COC Number		M031946	M031946			M031946		
	UNITS	MW16-17-5	MW16-17-5 Lab-Dup	RDL	QC Batch	MW16-12-3	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.00028	N/A	0.000020	8428460	0.000036	0.000020	8428460
Dissolved Calcium (Ca)	mg/L	410	N/A	0.30	8431017	270	0.30	8431036
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Cobalt (Co)	mg/L	0.00083	N/A	0.00030	8428460	<0.00030	0.00030	8428460
Dissolved Copper (Cu)	mg/L	0.0017	N/A	0.00020	8428460	0.0018	0.00020	8428460
Dissolved Iron (Fe)	mg/L	<0.060	N/A	0.060	8431017	<0.060	0.060	8431036
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8428460	<0.00020	0.00020	8428460
Dissolved Lithium (Li)	mg/L	0.15	N/A	0.020	8431017	0.030	0.020	8431036
Dissolved Magnesium (Mg)	mg/L	600 (1)	N/A	2.0	8431017	160	0.20	8431036
Dissolved Manganese (Mn)	mg/L	0.39	N/A	0.0040	8431017	0.025	0.0040	8431036
Dissolved Molybdenum (Mo)	mg/L	0.0015	N/A	0.00020	8428460	0.0021	0.00020	8428460
Dissolved Nickel (Ni)	mg/L	0.0054	N/A	0.00050	8428460	0.0041	0.00050	8428460
Dissolved Phosphorus (P)	mg/L	0.11	N/A	0.10	8431017	<0.10	0.10	8431036
Dissolved Potassium (K)	mg/L	11	N/A	0.30	8431017	6.4	0.30	8431036
Dissolved Selenium (Se)	mg/L	0.034	N/A	0.00020	8428460	0.0016	0.00020	8428460
Dissolved Silicon (Si)	mg/L	5.2	N/A	0.10	8431017	6.1	0.10	8431036
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8428460	<0.00010	0.00010	8428460
Dissolved Sodium (Na)	mg/L	750 (1)	N/A	5.0	8431017	110	0.50	8431036
Dissolved Strontium (Sr)	mg/L	4.7	N/A	0.020	8431017	1.1	0.020	8431036
Dissolved Sulphur (S)	mg/L	1500 (1)	N/A	2.0	8431017	270	0.20	8431036
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8428460	<0.00020	0.00020	8428460
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Uranium (U)	mg/L	0.031	N/A	0.00010	8428460	0.010	0.00010	8428460
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8428460	0.0011	0.0010	8428460
Dissolved Zinc (Zn)	mg/L	0.0062	N/A	0.0030	8428460	<0.0030	0.0030	8428460

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PS2812	PS2813		
Sampling Date		2016/10/06 10:10	2016/10/06 16:56		
COC Number		M031946	M031946		
	UNITS	MW16-17-5	MW16-12-3	RDL	QC Batch
Low Level Elements					
Total Mercury (Hg)	ug/L	<0.20 (1)	0.30 (1)	0.20	8435873
Lab Filtered Elements-Low					
Dissolved Mercury (Hg)	ug/L	<0.0020	<0.0020	0.0020	8431903

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	11.7°C

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428460	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/11		89	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/11		93	%	80 - 120
			Dissolved Arsenic (As)	2016/10/11		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/11		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/11		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/11		93	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/11		90	%	80 - 120
			Dissolved Copper (Cu)	2016/10/11		87	%	80 - 120
			Dissolved Lead (Pb)	2016/10/11		90	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/11		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/11		88	%	80 - 120
			Dissolved Selenium (Se)	2016/10/11		101	%	80 - 120
			Dissolved Silver (Ag)	2016/10/11		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/11		91	%	80 - 120
			Dissolved Tin (Sn)	2016/10/11		101	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/11		96	%	80 - 120
			Dissolved Uranium (U)	2016/10/11		91	%	80 - 120
			Dissolved Vanadium (V)	2016/10/11		95	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/11		90	%	80 - 120
8428460	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/11		119	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/11		88	%	80 - 120
			Dissolved Arsenic (As)	2016/10/11		88	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/11		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/11		88	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/11		91	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/11		87	%	80 - 120
			Dissolved Copper (Cu)	2016/10/11		89	%	80 - 120
			Dissolved Lead (Pb)	2016/10/11		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/11		89	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/11		86	%	80 - 120
			Dissolved Selenium (Se)	2016/10/11		93	%	80 - 120
			Dissolved Silver (Ag)	2016/10/11		89	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/11		90	%	80 - 120
			Dissolved Tin (Sn)	2016/10/11		83	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/11		85	%	80 - 120
			Dissolved Uranium (U)	2016/10/11		88	%	80 - 120
			Dissolved Vanadium (V)	2016/10/11		89	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/11		85	%	80 - 120
8428460	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/11	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/11	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/11	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/11	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/11	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/11	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/11	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/11	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/11	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/11	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/11	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/11	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/11	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/11	<0.00020		mg/L	

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/10/11	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/11	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/11	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/11	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/11	0.0046, RDL=0.0030		mg/L	
8428460	PC5	RPD	Dissolved Aluminum (Al)	2016/10/11	NC		%	20
			Dissolved Antimony (Sb)	2016/10/11	NC		%	20
			Dissolved Arsenic (As)	2016/10/11	NC		%	20
			Dissolved Beryllium (Be)	2016/10/11	NC		%	20
			Dissolved Chromium (Cr)	2016/10/11	NC		%	20
			Dissolved Cobalt (Co)	2016/10/11	6.4		%	20
			Dissolved Copper (Cu)	2016/10/11	NC		%	20
			Dissolved Lead (Pb)	2016/10/11	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/11	4.9		%	20
			Dissolved Nickel (Ni)	2016/10/11	1.7		%	20
			Dissolved Selenium (Se)	2016/10/11	NC		%	20
			Dissolved Silver (Ag)	2016/10/11	NC		%	20
			Dissolved Thallium (Tl)	2016/10/11	NC		%	20
			Dissolved Tin (Sn)	2016/10/11	NC		%	20
			Dissolved Titanium (Ti)	2016/10/11	NC		%	20
			Dissolved Uranium (U)	2016/10/11	0.93		%	20
			Dissolved Vanadium (V)	2016/10/11	NC		%	20
			Dissolved Zinc (Zn)	2016/10/11	NC		%	20
8428824	NW4	Matrix Spike [PS2812-01]	Dissolved Nitrite (N)	2016/10/11		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		101	%	80 - 120
8428824	NW4	Spiked Blank	Dissolved Nitrite (N)	2016/10/11		101	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		101	%	80 - 120
8428824	NW4	Method Blank	Dissolved Nitrite (N)	2016/10/11	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/11	<0.010		mg/L	
8428824	NW4	RPD [PS2812-01]	Dissolved Nitrite (N)	2016/10/11	0.48		%	20
			Dissolved Nitrate (N)	2016/10/11	0.053		%	20
8428827	NW4	Matrix Spike	Dissolved Nitrite (N)	2016/10/11		101	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		102	%	80 - 120
8428827	NW4	Spiked Blank	Dissolved Nitrite (N)	2016/10/11		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		101	%	80 - 120
8428827	NW4	Method Blank	Dissolved Nitrite (N)	2016/10/11	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/11	<0.010		mg/L	
8428827	NW4	RPD	Dissolved Nitrite (N)	2016/10/11	NC		%	20
			Dissolved Nitrate (N)	2016/10/11	0		%	20
8428917	JLD	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/11		99	%	80 - 120
8428917	JLD	Method Blank	Alkalinity (PP as CaCO3)	2016/10/11	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/11	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/11	<0.50		mg/L	
			Carbonate (CO3)	2016/10/11	<0.50		mg/L	
			Hydroxide (OH)	2016/10/11	<0.50		mg/L	
8428917	JLD	RPD	Alkalinity (PP as CaCO3)	2016/10/11	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/11	0.80		%	20
			Bicarbonate (HCO3)	2016/10/11	0.80		%	20
			Carbonate (CO3)	2016/10/11	NC		%	20
			Hydroxide (OH)	2016/10/11	NC		%	20
8428919	JLD	Spiked Blank	Conductivity	2016/10/11		99	%	90 - 110

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Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428919	JLD	Method Blank	Conductivity	2016/10/11	<1.0		uS/cm	
8428919	JLD	RPD	Conductivity	2016/10/11	0.15		%	20
8428920	JLD	Spiked Blank	pH	2016/10/11		101	%	97 - 103
8428920	JLD	RPD	pH	2016/10/11	0.43		%	N/A
8431017	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/12		86	%	80 - 120
			Dissolved Boron (B)	2016/10/12		90	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		86	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		99	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/12		93	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		NC	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		105	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		98	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		88	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		96	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		88	%	80 - 120
8431017	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/12		93	%	80 - 120
			Dissolved Boron (B)	2016/10/12		92	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		95	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		100	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/12		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		99	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		101	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		94	%	80 - 120
8431017	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/12	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/12	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/12	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/12	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/12	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/12	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/12	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/12	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/12	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/12	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/12	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/12	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/12	<0.20		mg/L	
8431017	JHC	RPD	Dissolved Calcium (Ca)	2016/10/12	0.75		%	20
			Dissolved Iron (Fe)	2016/10/12	11		%	20
			Dissolved Magnesium (Mg)	2016/10/12	0.97		%	20
			Dissolved Manganese (Mn)	2016/10/12	0.68		%	20
			Dissolved Potassium (K)	2016/10/12	0.28		%	20
			Dissolved Sodium (Na)	2016/10/12	0.24		%	20
8431036	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/12		93	%	80 - 120
			Dissolved Boron (B)	2016/10/12		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		95	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		100	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Magnesium (Mg)	2016/10/12		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		96	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		99	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		102	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		91	%	80 - 120
8431036	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/12		93	%	80 - 120
			Dissolved Boron (B)	2016/10/12		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		94	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		95	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		102	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/12		104	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		98	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		102	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		100	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		94	%	80 - 120
8431036	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/12	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/12	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/12	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/12	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/12	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/12	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/12	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/12	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/12	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/12	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/12	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/12	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/12	<0.20		mg/L	
8431036	JHC	RPD	Dissolved Calcium (Ca)	2016/10/12	NC		%	20
			Dissolved Iron (Fe)	2016/10/12	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/12	NC		%	20
			Dissolved Manganese (Mn)	2016/10/12	NC		%	20
			Dissolved Potassium (K)	2016/10/12	NC		%	20
			Dissolved Sodium (Na)	2016/10/12	NC		%	20
8431903	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/13		101	%	80 - 120
8431903	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/13		110	%	80 - 120
8431903	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/13	<0.0020		ug/L	
8431903	RK3	RPD	Dissolved Mercury (Hg)	2016/10/13	NC		%	20
8433409	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/14		NC	%	80 - 120
8433409	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/14		105	%	80 - 120
8433409	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/14	<1.0		mg/L	
8433409	ZI	RPD	Dissolved Chloride (Cl)	2016/10/14	13		%	20
8433413	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/14		NC	%	80 - 120
8433413	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/14		107	%	80 - 120
8433413	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/14	<1.0		mg/L	
8433413	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/14	0.68		%	20
8435873	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/17		82	%	80 - 120
8435873	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/17		81	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8435873	RK3	Method Blank	Total Mercury (Hg)	2016/10/17	0.0028, RDL=0.0020		ug/L	
8435873	RK3	RPD	Total Mercury (Hg)	2016/10/18	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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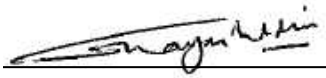
Maxxam Job #: B688395
Report Date: 2016/10/18

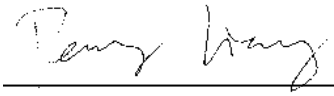
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics



Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

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Maxxam
A Bureau Veritas Group Company

Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD

M 031946

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required	
Company:	Stantec Consulting Ltd	Company:		Quotation #:		☑ 5 - 7 Days Regular (Most analyses)	
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address:	10160 112 St, Edmonton AB, T5K-2L6	Address:		Project #:	110773396	Rush TAT (Surcharges will be applied)	
Phone:	(780) 969-7223	Phone:		Site Location:	Springbank SR1	☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days	
Email:	Dylan.King@stantec.com	Email:		Site #:		Date Required:	
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet	Rush Confirmation #:	

Laboratory Use Only

	YES	NO	Cooler ID	Temp		
Seal Present		✓				
Seal Intact		✓				
Cooling Media	✓			12	12	11

	YES	NO	Cooler ID	Temp		
Seal Present						
Seal Intact						
Cooling Media						

	YES	NO	Cooler ID	Temp		
Seal Present						
Seal Intact						
Cooling Media						

Depot Reception

Analysis Requested

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Diss ☒ Tot ☐	Mercury Dissolved ☒ Total ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	HOLD - DO NOT ANALYZE
1	MW16-17-5		2016/10/06	10:10	W	1				✓	✓	✓					
2	MW16-12-3		2016/10/06	16:56	W	1				✓	✓	✓					
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

☑ AT1/CCME
☑ Drinking Water
☐ Saskatchewan
☐ D50 (Drilling Waste)
☐ Other:

Special Instructions

Due to low volume only Routine bottle filled. Please prioritize analysis to routine parameters followed by dissolved metals and finaly mercury if sufficient volume present

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
Dale Nisbet	2016/10/06	19:34	Jason Bil	2016 10 06	1835

06-Oct-16 18:35
Wendy Sears
B688395

AB FCD-00331/6

AV2 INS-0001

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031890

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/19
Report #: R2285204
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B685112
Received: 2016/09/29, 07:13

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	5	N/A	2016/09/30	AB SOP-00005	SM 22 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2016/10/01	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	6	N/A	2016/10/04	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	4	N/A	2016/10/02	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry	2	N/A	2016/10/03	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	6	2016/09/29	2016/09/30	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	6	2016/09/29	2016/09/30	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) (1)	6	N/A	2016/10/01	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	5	N/A	2016/09/30	AB SOP-00005	SM 22 2510 B m
Conductivity @25C	1	N/A	2016/10/01	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	2	2016/09/30	2016/10/01	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	4	2016/09/30	2016/10/02	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	6	N/A	2016/10/04	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	6	2016/10/03	2016/10/03	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	6	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	6	N/A	2016/10/01	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	6	N/A	2016/09/30	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	6	N/A	2016/09/30	AB WI-00065	Auto Calc
Sum of cations, anions	6	N/A	2016/10/04	AB WI-00065	Auto Calc
Ammonia-N (Dissolved)	6	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	6	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	6	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2016/09/30	AB SOP-00023	SM 22 4110 B m
Nitrogen, (Nitrite, Nitrate) by IC	5	N/A	2016/10/01	AB SOP-00023	SM 22 4110 B m
pH @25°C	5	N/A	2016/09/30	AB SOP-00005	SM 22 4500-H+B m
pH @25°C	1	N/A	2016/10/01	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	6	N/A	2016/09/30	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	4	N/A	2016/10/02	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry	2	N/A	2016/10/03	AB SOP-00018	SM 22 4500-SO4 E m

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031890

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/19
Report #: R2285204
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B685112
Received: 2016/09/29, 07:13

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Heterotrophic Plate Count	6	2016/09/29	2016/10/01	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	6	N/A	2016/10/04	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	1	2016/10/02	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	5	2016/10/03	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Phosphorus -P (Total, Dissolved)	6	2016/09/30	2016/10/01	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PQ0280	PQ0281	PQ0282	PQ0283	PQ0284	PQ0285		
Sampling Date		2016/09/28 10:16	2016/09/28 10:58	2016/09/28 11:45	2016/09/28 17:10	2016/09/28 17:11	2016/09/28 18:34		
COC Number		M031890	M031890	M031890	M031890	M031890	M031890		
	UNITS	MW16-27-9	MW16-26-18	MW16-3-7	MW16-24-30	MW16-15-16	MW16-22-26	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8416283
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8420469
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8420469
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8420469
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8420469
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	108	109	108	109	108	108	N/A	8420469
4-Bromofluorobenzene (sur.)	%	106	106	106	107	107	106	N/A	8420469
D4-1,2-Dichloroethane (sur.)	%	119	121	119	122	120	121	N/A	8420469
O-TERPHENYL (sur.)	%	133 (1)	92	82	82	82	85	N/A	8416283

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Surrogate recovery exceeds acceptance criteria (high recovery). As results are non-detect, there is no impact on data quality.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0280	PQ0280		PQ0281		
Sampling Date		2016/09/28 10:16	2016/09/28 10:16		2016/09/28 10:58		
COC Number		M031890	M031890		M031890		
	UNITS	MW16-27-9	MW16-27-9 Lab-Dup	QC Batch	MW16-26-18	RDL	QC Batch
Calculated Parameters							
Anion Sum	meq/L	25	N/A	8415152	14	N/A	8415152
Cation Sum	meq/L	22	N/A	8415152	14	N/A	8415152
Hardness (CaCO3)	mg/L	800	N/A	8415148	140	0.50	8415148
Ion Balance	N/A	0.90	N/A	8415150	1.0	0.010	8415150
Dissolved Nitrate (NO3)	mg/L	<0.044	N/A	8415154	<0.044	0.044	8415154
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	8415156	<0.020	0.020	8415156
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	8415154	<0.033	0.033	8415154
Calculated Total Dissolved Solids	mg/L	1400	N/A	8415158	870	10	8415158
Misc. Inorganics							
Conductivity	uS/cm	2000	N/A	8416121	1300	1.0	8416121
pH	pH	7.77	N/A	8416120	8.29	N/A	8416120
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	8416112	<0.50	0.50	8416112
Alkalinity (Total as CaCO3)	mg/L	530	N/A	8416112	260	0.50	8416112
Bicarbonate (HCO3)	mg/L	650	N/A	8416112	310	0.50	8416112
Carbonate (CO3)	mg/L	<0.50	N/A	8416112	<0.50	0.50	8416112
Hydroxide (OH)	mg/L	<0.50	N/A	8416112	<0.50	0.50	8416112
Dissolved Sulphate (SO4)	mg/L	690 (1)	N/A	8419223	400 (1)	5.0	8419230
Dissolved Chloride (Cl)	mg/L	2.1	N/A	8419222	2.0	1.0	8419229
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	8416726	<0.010	0.010	8416726
Dissolved Nitrate (N)	mg/L	<0.010	<0.010	8416726	<0.010	0.010	8416726
Elements							
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	8417228	0.0037	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	8417228	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.00036	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Barium (Ba)	mg/L	<0.010	N/A	8417829	<0.010	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.13	N/A	8417829	0.13	0.020	8417829

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0280	PQ0280		PQ0281		
Sampling Date		2016/09/28 10:16	2016/09/28 10:16		2016/09/28 10:58		
COC Number		M031890	M031890		M031890		
	UNITS	MW16-27-9	MW16-27-9 Lab-Dup	QC Batch	MW16-26-18	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.000026	N/A	8417228	<0.000020	0.000020	8417228
Dissolved Calcium (Ca)	mg/L	200	N/A	8417829	40	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	0.0014	N/A	8417228	<0.00030	0.00030	8417228
Dissolved Copper (Cu)	mg/L	<0.00020	N/A	8417228	0.00021	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.42	N/A	8417829	0.15	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.041	N/A	8417829	0.035	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	75	N/A	8417829	11	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.41	N/A	8417829	0.083	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.00058	N/A	8417228	0.0048	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	0.00062	N/A	8417228	<0.00050	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	8417829	<0.10	0.10	8417829
Dissolved Potassium (K)	mg/L	4.9	N/A	8417829	2.8	0.30	8417829
Dissolved Selenium (Se)	mg/L	<0.00020	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Silicon (Si)	mg/L	5.7	N/A	8417829	4.5	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	8417228	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	140	N/A	8417829	250	0.50	8417829
Dissolved Strontium (Sr)	mg/L	1.6	N/A	8417829	0.61	0.020	8417829
Dissolved Sulphur (S)	mg/L	180	N/A	8417829	130	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.0049	N/A	8417228	0.00013	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	8417228	<0.0030	0.0030	8417228

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0282			PQ0283	PQ0283		
Sampling Date		2016/09/28 11:45			2016/09/28 17:10	2016/09/28 17:10		
COC Number		M031890			M031890	M031890		
	UNITS	MW16-3-7	RDL	QC Batch	MW16-24-30	MW16-24-30 Lab-Dup	RDL	QC Batch
Calculated Parameters								
Anion Sum	meq/L	32	N/A	8415152	13	N/A	N/A	8415152
Cation Sum	meq/L	33	N/A	8415152	14	N/A	N/A	8415152
Hardness (CaCO3)	mg/L	950	0.50	8415148	160	N/A	0.50	8415148
Ion Balance	N/A	1.0	0.010	8415150	1.1	N/A	0.010	8415150
Dissolved Nitrate (NO3)	mg/L	1.3	0.044	8415154	<0.044	N/A	0.044	8415154
Nitrate plus Nitrite (N)	mg/L	0.30	0.020	8415156	<0.020	N/A	0.020	8415156
Dissolved Nitrite (NO2)	mg/L	0.051	0.033	8415154	<0.033	N/A	0.033	8415154
Calculated Total Dissolved Solids	mg/L	2000	10	8415158	730	N/A	10	8415158
Misc. Inorganics								
Conductivity	uS/cm	2600	1.0	8416130	1100	N/A	1.0	8416121
pH	pH	8.16	N/A	8416129	8.19	N/A	N/A	8416120
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8416126	<0.50	N/A	0.50	8416112
Alkalinity (Total as CaCO3)	mg/L	450	0.50	8416126	460	N/A	0.50	8416112
Bicarbonate (HCO3)	mg/L	550	0.50	8416126	560	N/A	0.50	8416112
Carbonate (CO3)	mg/L	<0.50	0.50	8416126	<0.50	N/A	0.50	8416112
Hydroxide (OH)	mg/L	<0.50	0.50	8416126	<0.50	N/A	0.50	8416112
Dissolved Sulphate (SO4)	mg/L	1100 (1)	10	8419661	160	N/A	1.0	8419223
Dissolved Chloride (Cl)	mg/L	12	1.0	8419658	<1.0	N/A	1.0	8419222
Nutrients								
Dissolved Nitrite (N)	mg/L	0.016	0.010	8416726	<0.010	N/A	0.010	8416726
Dissolved Nitrate (N)	mg/L	0.29	0.010	8416726	<0.010	N/A	0.010	8416726
Elements								
Dissolved Aluminum (Al)	mg/L	0.0064	0.0030	8417228	<0.0030	<0.0030	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8417228	<0.00060	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.00078	0.00020	8417228	0.0023	0.0022	0.00020	8417228
Dissolved Barium (Ba)	mg/L	0.035	0.010	8417829	0.019	N/A	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.10	0.020	8417829	0.089	N/A	0.020	8417829

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0282			PQ0283	PQ0283		
Sampling Date		2016/09/28 11:45			2016/09/28 17:10	2016/09/28 17:10		
COC Number		M031890			M031890	M031890		
	UNITS	MW16-3-7	RDL	QC Batch	MW16-24-30	MW16-24-30 Lab-Dup	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.000036	0.000020	8417228	<0.000020	<0.000020	0.000020	8417228
Dissolved Calcium (Ca)	mg/L	170	0.30	8417829	38	N/A	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	0.0023	0.00030	8417228	<0.00030	<0.00030	0.00030	8417228
Dissolved Copper (Cu)	mg/L	0.00085	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.17	0.060	8417829	0.14	N/A	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.057	0.020	8417829	0.054	N/A	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	130	0.20	8417829	16	N/A	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.39	0.0040	8417829	0.067	N/A	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.0020	0.00020	8417228	0.0014	0.0013	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	0.0065	0.00050	8417228	<0.00050	<0.00050	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8417829	<0.10	N/A	0.10	8417829
Dissolved Potassium (K)	mg/L	6.1	0.30	8417829	4.0	N/A	0.30	8417829
Dissolved Selenium (Se)	mg/L	0.00026	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Silicon (Si)	mg/L	5.1	0.10	8417829	3.6	N/A	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8417228	<0.00010	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	320	0.50	8417829	240	N/A	0.50	8417829
Dissolved Strontium (Sr)	mg/L	1.6	0.020	8417829	0.66	N/A	0.020	8417829
Dissolved Sulphur (S)	mg/L	370	0.20	8417829	51	N/A	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.014	0.00010	8417228	0.00022	0.00019	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8417228	<0.0030	<0.0030	0.0030	8417228

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0284			PQ0285		
Sampling Date		2016/09/28 17:11			2016/09/28 18:34		
COC Number		M031890			M031890		
	UNITS	MW16-15-16	RDL	QC Batch	MW16-22-26	RDL	QC Batch
Calculated Parameters							
Anion Sum	meq/L	12	N/A	8415152	26	N/A	8415152
Cation Sum	meq/L	14	N/A	8415152	26	N/A	8415152
Hardness (CaCO3)	mg/L	160	0.50	8415148	640	0.50	8415148
Ion Balance	N/A	1.1	0.010	8415150	1.0	0.010	8415150
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8415154	0.054	0.044	8415154
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8415156	<0.020	0.020	8415156
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8415154	<0.033	0.033	8415154
Calculated Total Dissolved Solids	mg/L	720	10	8415158	1700	10	8415158
Misc. Inorganics							
Conductivity	uS/cm	1100	1.0	8416121	2200	1.0	8416121
pH	pH	8.18	N/A	8416120	8.04	N/A	8416120
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8416112	<0.50	0.50	8416112
Alkalinity (Total as CaCO3)	mg/L	460	0.50	8416112	180	0.50	8416112
Bicarbonate (HCO3)	mg/L	560	0.50	8416112	220	0.50	8416112
Carbonate (CO3)	mg/L	<0.50	0.50	8416112	<0.50	0.50	8416112
Hydroxide (OH)	mg/L	<0.50	0.50	8416112	<0.50	0.50	8416112
Dissolved Sulphate (SO4)	mg/L	150	1.0	8419661	1100 (1)	10	8419223
Dissolved Chloride (Cl)	mg/L	2.4	1.0	8419658	4.9	1.0	8419222
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8416726	<0.010	0.010	8416726
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8416726	0.012	0.010	8416726
Elements							
Dissolved Aluminum (Al)	mg/L	<0.0030	0.0030	8417228	0.0036	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8417228	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.0022	0.00020	8417228	0.00073	0.00020	8417228
Dissolved Barium (Ba)	mg/L	0.018	0.010	8417829	0.034	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.089	0.020	8417829	0.098	0.020	8417829
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8417228	<0.000020	0.000020	8417228

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0284			PQ0285		
Sampling Date		2016/09/28 17:11			2016/09/28 18:34		
COC Number		M031890			M031890		
	UNITS	MW16-15-16	RDL	QC Batch	MW16-22-26	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	38	0.30	8417829	170	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8417228	0.00087	0.00030	8417228
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.15	0.060	8417829	0.11	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.053	0.020	8417829	0.064	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	15	0.20	8417829	54	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.066	0.0040	8417829	0.51	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.0015	0.00020	8417228	0.0039	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8417228	0.0018	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8417829	<0.10	0.10	8417829
Dissolved Potassium (K)	mg/L	3.9	0.30	8417829	7.1	0.30	8417829
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8417228	0.00023	0.00020	8417228
Dissolved Silicon (Si)	mg/L	3.6	0.10	8417829	4.8	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8417228	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	230	0.50	8417829	310	0.50	8417829
Dissolved Strontium (Sr)	mg/L	0.65	0.020	8417829	2.4	0.020	8417829
Dissolved Sulphur (S)	mg/L	50	0.20	8417829	350	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.00020	0.00010	8417228	0.0044	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8417228	<0.0030	0.0030	8417228
RDL = Reportable Detection Limit							

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ0280	PQ0280		PQ0281	PQ0281		PQ0282		
Sampling Date		2016/09/28 10:16	2016/09/28 10:16		2016/09/28 10:58	2016/09/28 10:58		2016/09/28 11:45		
COC Number		M031890	M031890		M031890	M031890		M031890		
	UNITS	MW16-27-9	MW16-27-9 Lab-Dup	RDL	MW16-26-18	MW16-26-18 Lab-Dup	QC Batch	MW16-3-7	RDL	QC Batch
Misc. Inorganics										
Dissolved Organic Carbon (C)	mg/L	1.8	N/A	0.50	2.1	N/A	8418320	8.0	0.50	8418320
Microbiological Param.										
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	<10 (1)	N/A	8415435	<10 (1)	10	8415435
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	<10 (1)	N/A	8415437	<10 (1)	10	8415437
Heterotrophic Plate Count	CFU/mL	980	1100	1.0	>6000	>6000	8415432	>6000	1.0	8415432
Total Coliforms DST	mpn/100mL	850 (1)	N/A	10	580 (1)	N/A	8415435	450 (1)	10	8415435
Nutrients										
Dissolved Ammonia (N)	mg/L	0.38	N/A	0.050	0.64	N/A	8417670	0.20	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	1.1	N/A	0.050	4.5 (1)	N/A	8419317	1.7 (1)	0.25	8419317
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	<0.0030	N/A	8417394	0.0099 (2)	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	0.0062	N/A	8416951	0.0067	0.0030	8416975

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Orthophosphate greater than dissolved and total phosphate. Results within acceptable limits of precision.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ0282			PQ0283	PQ0283		PQ0284		
Sampling Date		2016/09/28 11:45			2016/09/28 17:10	2016/09/28 17:10		2016/09/28 17:11		
COC Number		M031890			M031890	M031890		M031890		
	UNITS	MW16-3-7 Lab-Dup	RDL	QC Batch	MW16-24-30	MW16-24-30 Lab-Dup	QC Batch	MW16-15-16	RDL	QC Batch
Misc. Inorganics										
Dissolved Organic Carbon (C)	mg/L	N/A	0.50	8418320	1.2	1.2	8418321	1.4	0.50	8418321
Microbiological Param.										
E.Coli DST	mpn/100mL	N/A	10	8415435	<1.0	N/A	8415435	<1.0	1.0	8415435
Fecal Coliforms	MPN/100mL	N/A	10	8415437	<1.0	N/A	8415437	<1.0	1.0	8415437
Heterotrophic Plate Count	CFU/mL	>6000	1.0	8415432	48	50	8415432	120	1.0	8415432
Total Coliforms DST	mpn/100mL	N/A	10	8415435	2.0	N/A	8415435	1.0	1.0	8415435
Nutrients										
Dissolved Ammonia (N)	mg/L	N/A	0.050	8417670	0.86	N/A	8417670	0.84 (1)	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	N/A	0.25	8419317	0.88	N/A	8419053	0.81	0.050	8419317
Orthophosphate (P)	mg/L	N/A	0.0030	8417394	<0.0030	N/A	8417394	<0.0030	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	N/A	0.0030	8416975	<0.0030	N/A	8416951	0.0069	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Ammonia greater than TKN. Results are within acceptable limits of precision.

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ0284		PQ0285	PQ0285		
Sampling Date		2016/09/28 17:11		2016/09/28 18:34	2016/09/28 18:34		
COC Number		M031890		M031890	M031890		
	UNITS	MW16-15-16 Lab-Dup	RDL	MW16-22-26	MW16-22-26 Lab-Dup	RDL	QC Batch
Misc. Inorganics							
Dissolved Organic Carbon (C)	mg/L	N/A	0.50	3.3	N/A	0.50	8418321
Microbiological Param.							
E.Coli DST	mpn/100mL	<1.0	1.0	<10 (1)	N/A	10	8415435
Fecal Coliforms	MPN/100mL	<1.0	1.0	<10 (1)	N/A	10	8415437
Heterotrophic Plate Count	CFU/mL	110	1.0	>6000	>6000	1.0	8415432
Total Coliforms DST	mpn/100mL	1.0	1.0	2000 (1)	N/A	10	8415435
Nutrients							
Dissolved Ammonia (N)	mg/L	N/A	0.050	0.68	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	N/A	0.050	0.97	N/A	0.050	8419317
Orthophosphate (P)	mg/L	N/A	0.0030	0.0076 (2)	N/A	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	N/A	0.0030	<0.0030	N/A	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Orthophosphate greater than total phosphate. Results within acceptable limits of precision.

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PQ0280		PQ0281	PQ0282		PQ0283	PQ0284		
Sampling Date		2016/09/28 10:16		2016/09/28 10:58	2016/09/28 11:45		2016/09/28 17:10	2016/09/28 17:11		
COC Number		M031890		M031890	M031890		M031890	M031890		
	UNITS	MW16-27-9	RDL	MW16-26-18	MW16-3-7	RDL	MW16-24-30	MW16-15-16	RDL	QC Batch
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	0.0020	8419725
Total Mercury (Hg)	ug/L	<20 (1)	20	<6.0 (1)	<6.0 (1)	6.0	<0.0020	<0.0020	0.0020	8417247

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PQ0285		
Sampling Date		2016/09/28 18:34		
COC Number		M031890		
	UNITS	MW16-22-26	RDL	QC Batch
Low Level Elements				
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	8419725
Total Mercury (Hg)	ug/L	<6.0 (1)	6.0	8417247

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.0°C
Package 2	5.7°C

As per client request, the client ID for sample PQ0283 was changed from MW16-15-30 to MW16-24-30. The client request was received 2016/10/19.

Results relate only to the items tested.

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STANTEC CONSULTING LTD
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Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8415432	GK1	Method Blank	Heterotrophic Plate Count	2016/10/01	<1.0		CFU/mL	
8415432	GK1	RPD [PQ0280-07]	Heterotrophic Plate Count	2016/10/01	12		%	N/A
8415432	GK1	RPD [PQ0281-07]	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415432	GK1	RPD [PQ0282-07]	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415432	GK1	RPD [PQ0283-07]	Heterotrophic Plate Count	2016/10/01	4.1		%	N/A
8415432	GK1	RPD [PQ0284-07]	Heterotrophic Plate Count	2016/10/01	6.8		%	N/A
8415432	GK1	RPD [PQ0285-07]	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415432	GK1	RPD	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
			Heterotrophic Plate Count	2016/10/01	NC		%	N/A
			Heterotrophic Plate Count	2016/10/01	NC		%	N/A
			Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415435	GK1	Method Blank	E.Coli DST	2016/09/30	<1.0		mpn/100	
			Total Coliforms DST	2016/09/30	<1.0		mpn/100	
8415435	GK1	RPD [PQ0284-07]	E.Coli DST	2016/09/30	NC		%	N/A
			Total Coliforms DST	2016/09/30	NC		%	N/A
8415437	GK1	Method Blank	Fecal Coliforms	2016/09/30	<1.0		MPN/10	
8415437	GK1	RPD [PQ0284-07]	Fecal Coliforms	2016/09/30	NC		%	N/A
8416112	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/30		94	%	80 - 120
8416112	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/09/30	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/30	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/30	<0.50		mg/L	
			Carbonate (CO3)	2016/09/30	<0.50		mg/L	
			Hydroxide (OH)	2016/09/30	<0.50		mg/L	
8416112	IK0	RPD	Alkalinity (PP as CaCO3)	2016/09/30	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/30	NC		%	20
			Bicarbonate (HCO3)	2016/09/30	NC		%	20
			Carbonate (CO3)	2016/09/30	NC		%	20
			Hydroxide (OH)	2016/09/30	NC		%	20
8416120	IK0	Spiked Blank	pH	2016/09/30		100	%	97 - 103
8416120	IK0	RPD	pH	2016/09/30	0.55		%	N/A
8416121	IK0	Spiked Blank	Conductivity	2016/09/30		100	%	90 - 110
8416121	IK0	Method Blank	Conductivity	2016/09/30	<1.0		uS/cm	
8416121	IK0	RPD	Conductivity	2016/09/30	NC		%	20
8416126	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/01		98	%	80 - 120
8416126	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/01	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/01	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/01	<0.50		mg/L	
			Carbonate (CO3)	2016/10/01	<0.50		mg/L	
			Hydroxide (OH)	2016/10/01	<0.50		mg/L	
8416126	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/01	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/01	5.3		%	20
			Bicarbonate (HCO3)	2016/10/01	5.3		%	20
			Carbonate (CO3)	2016/10/01	NC		%	20
			Hydroxide (OH)	2016/10/01	NC		%	20
8416129	IK0	Spiked Blank	pH	2016/10/01		101	%	97 - 103
8416129	IK0	RPD	pH	2016/10/01	0.18		%	N/A
8416130	IK0	Spiked Blank	Conductivity	2016/10/01		99	%	90 - 110
8416130	IK0	Method Blank	Conductivity	2016/10/01	<1.0		uS/cm	
8416130	IK0	RPD	Conductivity	2016/10/01	0.32		%	20
8416283	VP4	Matrix Spike	O-TERPHENYL (sur.)	2016/10/01		85	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/01		89	%	50 - 130
8416283	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/10/01		86	%	50 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F2 (C10-C16 Hydrocarbons)	2016/10/01		90	%	70 - 130
8416283	VP4	Method Blank	O-TERPHENYL (sur.)	2016/10/01		87	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/01	<0.10		mg/L	
8416283	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/01	NC		%	40
8416726	JLD	Matrix Spike [PQ0280-01]	Dissolved Nitrite (N)	2016/10/01		108	%	80 - 120
			Dissolved Nitrate (N)	2016/10/01		109	%	80 - 120
8416726	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/30		101	%	80 - 120
			Dissolved Nitrate (N)	2016/09/30		101	%	80 - 120
8416726	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/30	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/30	<0.010		mg/L	
8416726	JLD	RPD [PQ0280-01]	Dissolved Nitrite (N)	2016/10/01	NC		%	20
			Dissolved Nitrate (N)	2016/10/01	NC		%	20
8416951	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		103	%	80 - 120
8416951	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		104	%	80 - 120
8416951	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		100	%	80 - 120
8416951	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	0.0037, RDL=0.0030		mg/L	
8416951	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	NC		%	20
8416975	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		98	%	80 - 120
8416975	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		0.0	%	N/A
8416975	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		102	%	80 - 120
8416975	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	<0.0030		mg/L	
8416975	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	3.0		%	20
8417228	PC5	Matrix Spike [PQ0283-04]	Dissolved Aluminum (Al)	2016/09/30		104	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		87	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		94	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		92	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		88	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		89	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		96	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		94	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		94	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		91	%	80 - 120
8417228	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/30		105	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		90	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		93	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2016/09/30		88	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		95	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		91	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		100	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		93	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		89	%	80 - 120
8417228	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/30	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/30	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/30	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/30	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/30	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/30	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/30	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/30	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/30	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/30	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/30	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/30	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/30	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/30	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/30	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/30	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/30	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/30	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/30	<0.0030		mg/L	
8417228	PC5	RPD [PQ0283-04]	Dissolved Aluminum (Al)	2016/09/30	NC		%	20
			Dissolved Antimony (Sb)	2016/09/30	NC		%	20
			Dissolved Arsenic (As)	2016/09/30	2.8		%	20
			Dissolved Beryllium (Be)	2016/09/30	NC		%	20
			Dissolved Cadmium (Cd)	2016/09/30	NC		%	20
			Dissolved Chromium (Cr)	2016/09/30	NC		%	20
			Dissolved Cobalt (Co)	2016/09/30	NC		%	20
			Dissolved Copper (Cu)	2016/09/30	NC		%	20
			Dissolved Lead (Pb)	2016/09/30	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/30	6.0		%	20
			Dissolved Nickel (Ni)	2016/09/30	NC		%	20
			Dissolved Selenium (Se)	2016/09/30	NC		%	20
			Dissolved Silver (Ag)	2016/09/30	NC		%	20
			Dissolved Thallium (Tl)	2016/09/30	NC		%	20
			Dissolved Tin (Sn)	2016/09/30	NC		%	20
			Dissolved Titanium (Ti)	2016/09/30	NC		%	20
			Dissolved Uranium (U)	2016/09/30	NC		%	20
			Dissolved Vanadium (V)	2016/09/30	NC		%	20
			Dissolved Zinc (Zn)	2016/09/30	NC		%	20
8417247	RK3	Matrix Spike	Total Mercury (Hg)	2016/09/30		109	%	80 - 120
8417247	RK3	Spiked Blank	Total Mercury (Hg)	2016/09/30		104	%	80 - 120
8417247	RK3	Method Blank	Total Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417247	RK3	RPD	Total Mercury (Hg)	2016/09/30	NC		%	20
8417394	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		96	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8417394	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417394	MB5	RPD	Orthophosphate (P)	2016/09/30	1.7		%	20
8417670	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	3.2		%	20
8417829	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/01		112	%	80 - 120
			Dissolved Boron (B)	2016/10/01		104	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		111	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		114	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		106	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		105	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		118	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		115	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		111	%	80 - 120
8417829	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/01		105	%	80 - 120
			Dissolved Boron (B)	2016/10/01		97	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		106	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		107	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		103	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		107	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		100	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		109	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		105	%	80 - 120
8417829	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/01	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/01	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/01	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/01	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/01	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/01	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/01	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/01	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/01	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/01	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/01	0.50, RDL=0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/01	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/01	<0.20		mg/L	
8417829	JHC	RPD	Dissolved Barium (Ba)	2016/10/01	0.047		%	20
			Dissolved Boron (B)	2016/10/01	0.55		%	20
			Dissolved Calcium (Ca)	2016/10/01	0.15		%	20
			Dissolved Iron (Fe)	2016/10/01	1.3		%	20
			Dissolved Lithium (Li)	2016/10/01	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/01	0.13		%	20
			Dissolved Manganese (Mn)	2016/10/01	0.044		%	20

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STANTEC CONSULTING LTD
Client Project #: 110773396
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Phosphorus (P)	2016/10/01	NC		%	20
			Dissolved Potassium (K)	2016/10/01	0.21		%	20
			Dissolved Silicon (Si)	2016/10/01	0.18		%	20
			Dissolved Sodium (Na)	2016/10/01	0.084		%	20
			Dissolved Strontium (Sr)	2016/10/01	0.045		%	20
			Dissolved Sulphur (S)	2016/10/01	0.25		%	20
8418320	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/01		NC	%	80 - 120
8418320	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		99	%	80 - 120
8418320	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418320	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/01	5.2		%	20
8418321	MUK	Matrix Spike [PQ0283-03]	Dissolved Organic Carbon (C)	2016/10/01		109	%	80 - 120
8418321	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		97	%	80 - 120
8418321	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418321	MUK	RPD [PQ0283-03]	Dissolved Organic Carbon (C)	2016/10/01	NC		%	20
8419053	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		NC	%	80 - 120
8419053	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		93	%	80 - 120
8419053	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		105	%	80 - 120
8419053	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419053	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	8.0		%	20
8419222	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/02		NC	%	80 - 120
8419222	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/02		106	%	80 - 120
8419222	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/02	<1.0		mg/L	
8419222	KP9	RPD	Dissolved Chloride (Cl)	2016/10/02	2.6		%	20
8419223	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/02		NC	%	80 - 120
8419223	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/02		106	%	80 - 120
8419223	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/02	<1.0		mg/L	
8419223	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/02	0.91		%	20
8419229	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/02		NC	%	80 - 120
8419229	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/02		106	%	80 - 120
8419229	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/02	<1.0		mg/L	
8419229	KP9	RPD	Dissolved Chloride (Cl)	2016/10/02	7.3		%	20
8419230	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/02		NC	%	80 - 120
8419230	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/02		105	%	80 - 120
8419230	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/02	<1.0		mg/L	
8419230	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/02	0.58		%	20
8419317	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		100	%	80 - 120
8419317	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		97	%	80 - 120
8419317	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		109	%	80 - 120
8419317	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419317	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	3.2		%	20
8419658	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/03		NC	%	80 - 120
8419658	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/03		105	%	80 - 120
8419658	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/03	1.6, RDL=1.0		mg/L	
8419658	KP9	RPD	Dissolved Chloride (Cl)	2016/10/03	0.93		%	20
8419661	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/03		NC	%	80 - 120
8419661	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/03		107	%	80 - 120
8419661	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/03	<1.0		mg/L	
8419661	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/03	1.8		%	20
8419725	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/03		93	%	80 - 120
8419725	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/03		91	%	80 - 120
8419725	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/03	<0.0020		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8419725	RK3	RPD	Dissolved Mercury (Hg)	2016/10/03	NC		%	20
8420469	RSA	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/04		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/04		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/04		121	%	70 - 130
			Benzene	2016/10/04		111	%	70 - 130
			Toluene	2016/10/04		107	%	70 - 130
			Ethylbenzene	2016/10/04		112	%	70 - 130
			m & p-Xylene	2016/10/04		110	%	70 - 130
			o-Xylene	2016/10/04		114	%	70 - 130
			F1 (C6-C10)	2016/10/04		84	%	70 - 130
8420469	RSA	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/04		110	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/04		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/04		119	%	70 - 130
			Benzene	2016/10/04		111	%	70 - 130
			Toluene	2016/10/04		108	%	70 - 130
			Ethylbenzene	2016/10/04		114	%	70 - 130
			m & p-Xylene	2016/10/04		113	%	70 - 130
			o-Xylene	2016/10/04		115	%	70 - 130
			F1 (C6-C10)	2016/10/04		102	%	70 - 130
8420469	RSA	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/04		110	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/04		105	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/04		119	%	70 - 130
			Benzene	2016/10/04	<0.00040		mg/L	
			Toluene	2016/10/04	<0.00040		mg/L	
			Ethylbenzene	2016/10/04	<0.00040		mg/L	
			m & p-Xylene	2016/10/04	<0.00080		mg/L	
			o-Xylene	2016/10/04	<0.00040		mg/L	
			Xylenes (Total)	2016/10/04	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/04	<0.10		mg/L	
			F1 (C6-C10)	2016/10/04	<0.10		mg/L	
8420469	RSA	RPD	Benzene	2016/10/04	NC		%	40
			Toluene	2016/10/04	NC		%	40
			Ethylbenzene	2016/10/04	NC		%	40
			m & p-Xylene	2016/10/04	NC		%	40
			o-Xylene	2016/10/04	NC		%	40
			Xylenes (Total)	2016/10/04	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/04	NC		%	40

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/04	NC		%	40

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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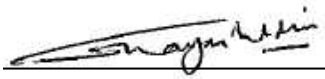
VALIDATION SIGNATURE PAGE

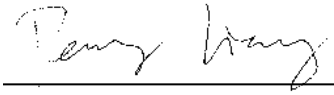
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics



Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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CHAIN OF CUSTODY RECORD

M 031890

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Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required
Company:	Stantec consulting Ltd	Company:		Quotation #:		☑ 5 - 7 Days Regular (Most analyses)
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	10160 112 St, Edmonton AB, T5K 2L6	Address:		Project #:	110773396	Rush TAT (Surcharges will be applied)
Phone:	(780)969-2223	Phone:		Site Location:	Springbank SR1	☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Email:	Dylanking@stantec.com	Email:		Site #:		Date Required:
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D.Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID	Temp		
Seal Present	✓					
Seal Intact	✓					
Cooling Media	✓					
	YES	NO	Cooler ID	Temp		
Seal Present	✓					
Seal Intact	✓					
Cooling Media	✓					
	YES	NO	Cooler ID	Temp		
Seal Present						
Seal Intact						
Cooling Media						

Depot Reception

Regulatory Criteria: ☑ AT1/CCME ☑ Drinking Water ☐ Saskatchewan ☐ D50 (Drilling Waste) ☐ Other:

Special Instructions

	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorous Phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic Plate Count	HOLD - DO NOT ANALYZE
1	MW16-27-9		2016/09/28	10:16	W	13		✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	5 7 9
2	MW16-26-18		↓	10:58	↓	↓	↓	↓		↓	↓	↓					↓	↓	↓	↓	↓	↓	↓	↓	8.8.16
3	MW16-3-7			11:45																					7.9.16
4	MW16-15-30			17:10																					6.6.16
5	MW16-15-16			17:11																					5.5.16
6	MW16-22-26			14:34																					6.5.16
7																									
8																									
9																									
10																									

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Submitted same day as sampled. Could not eliminate headspace in MW16-27-9 sample F2 bottle due to gas created from interacting with preservative

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/28	20:13	[signature]	2016/09/29	07:13

29-Sep-16 07:13
Wendy Sears
B685112

JBK INS-0074

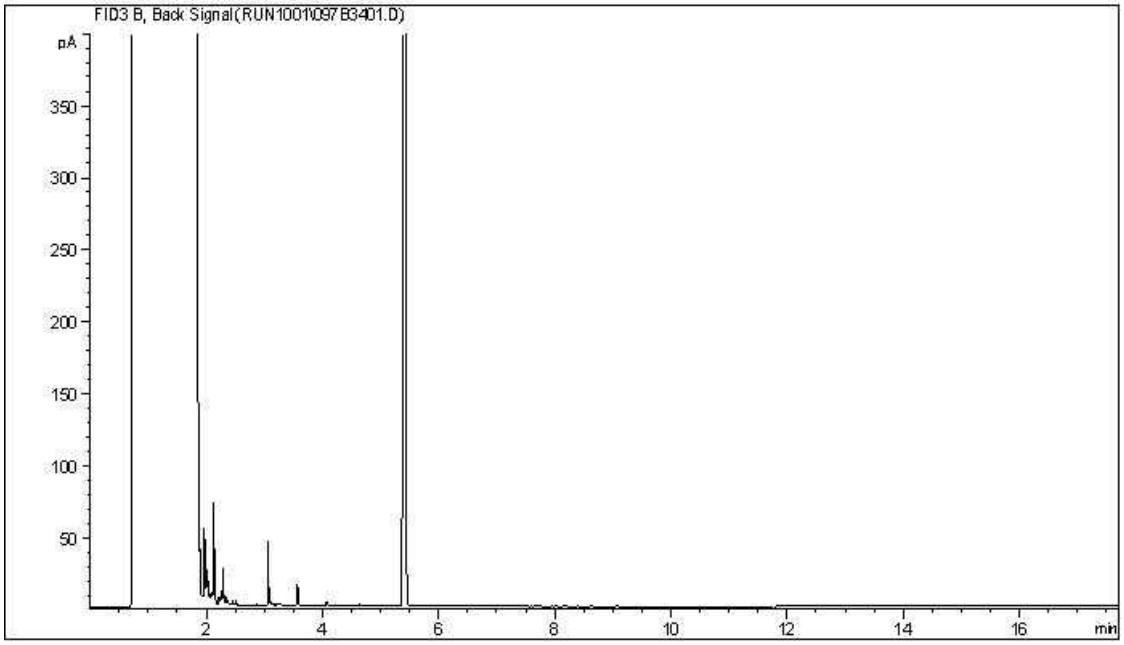
AB FCD-00331/6

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0280

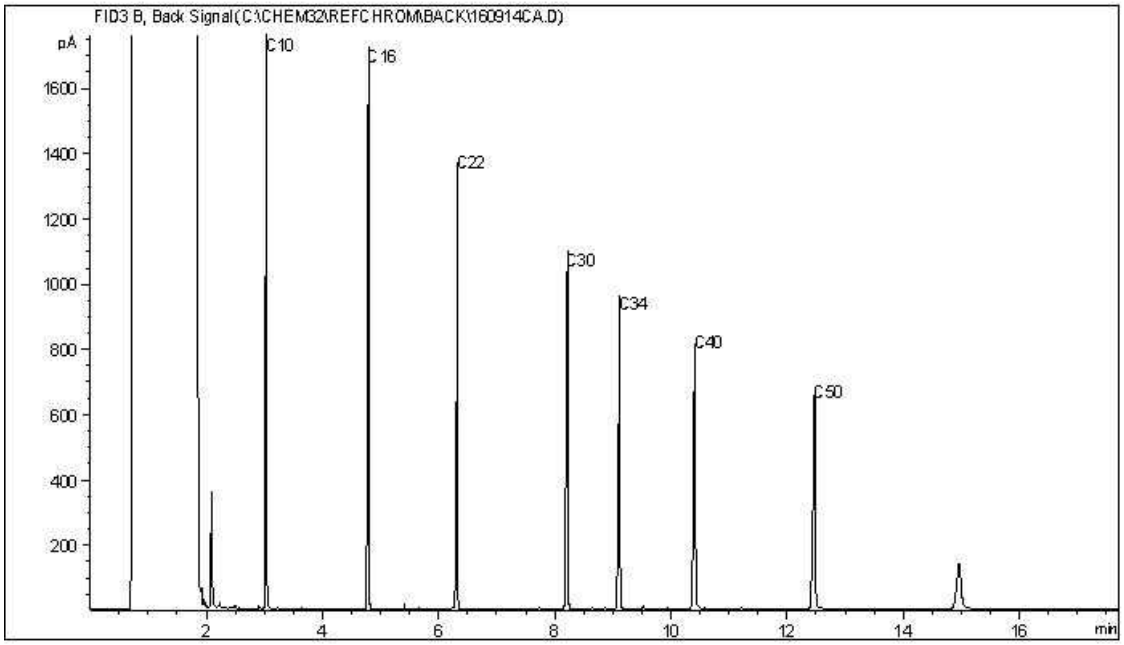
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-27-9

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

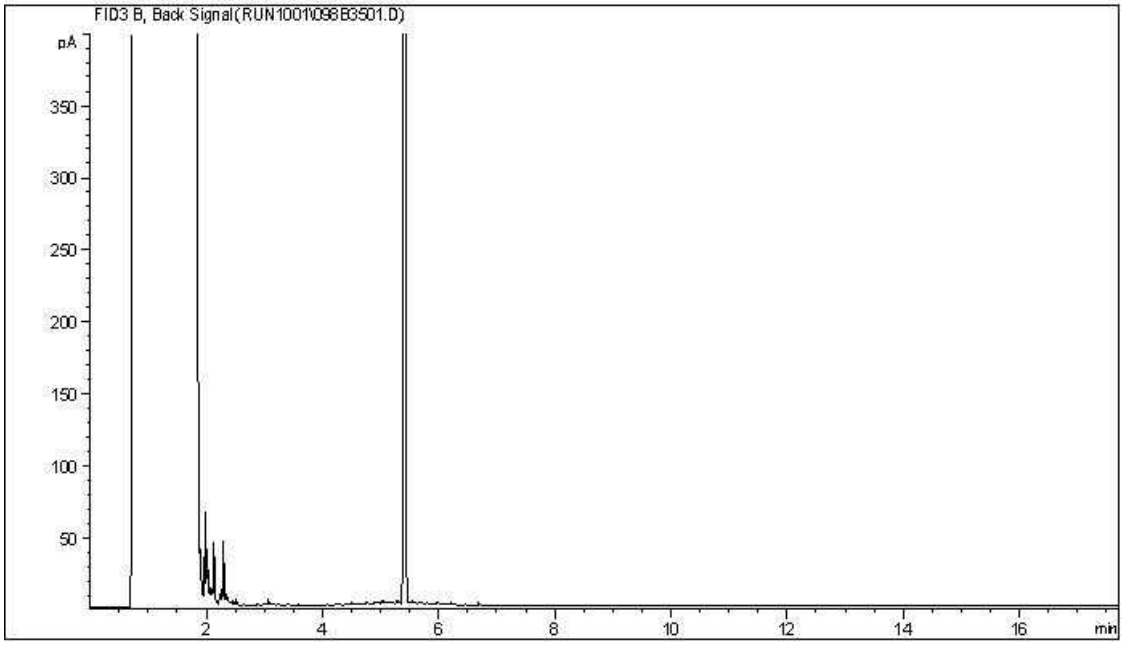
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0281

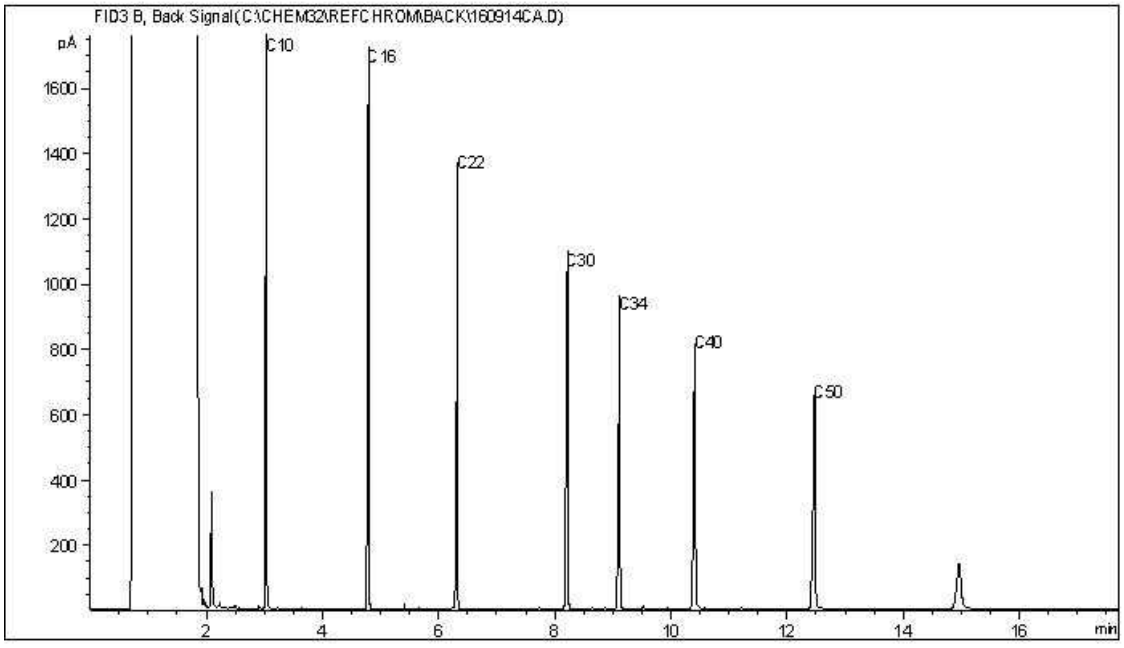
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-26-18

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

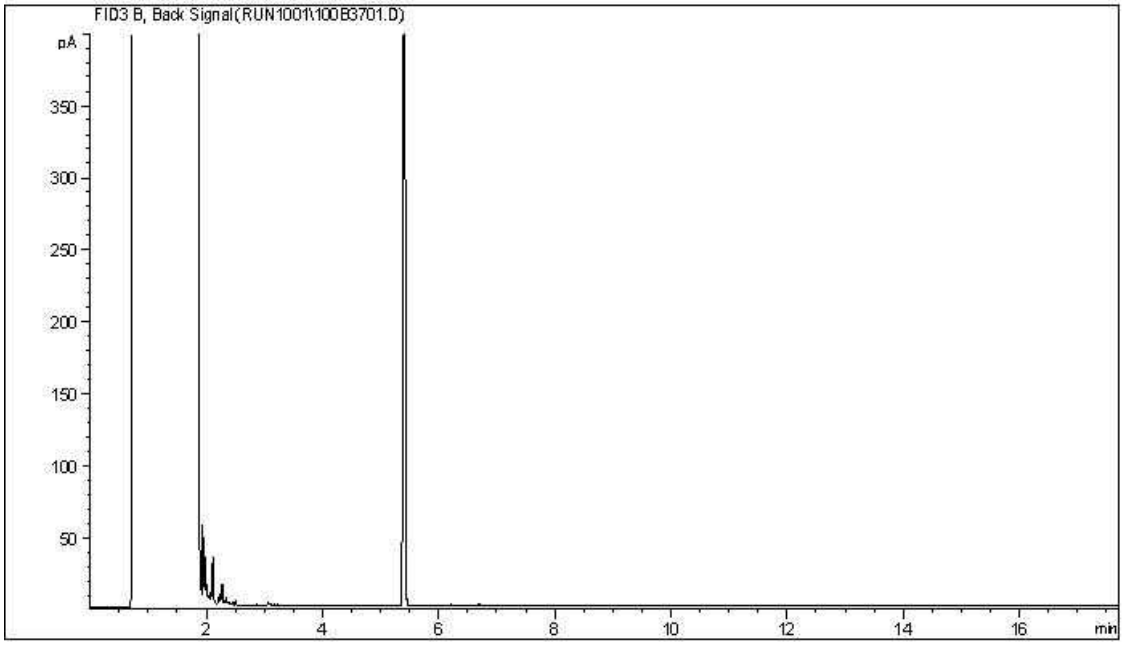
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0282

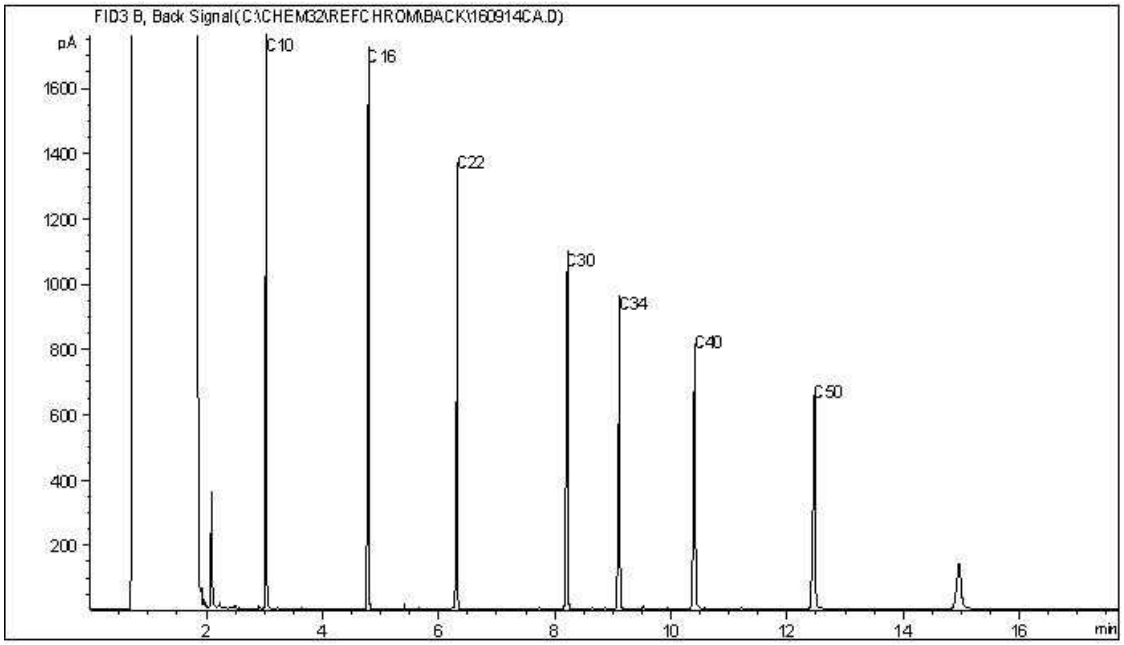
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-3-7

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

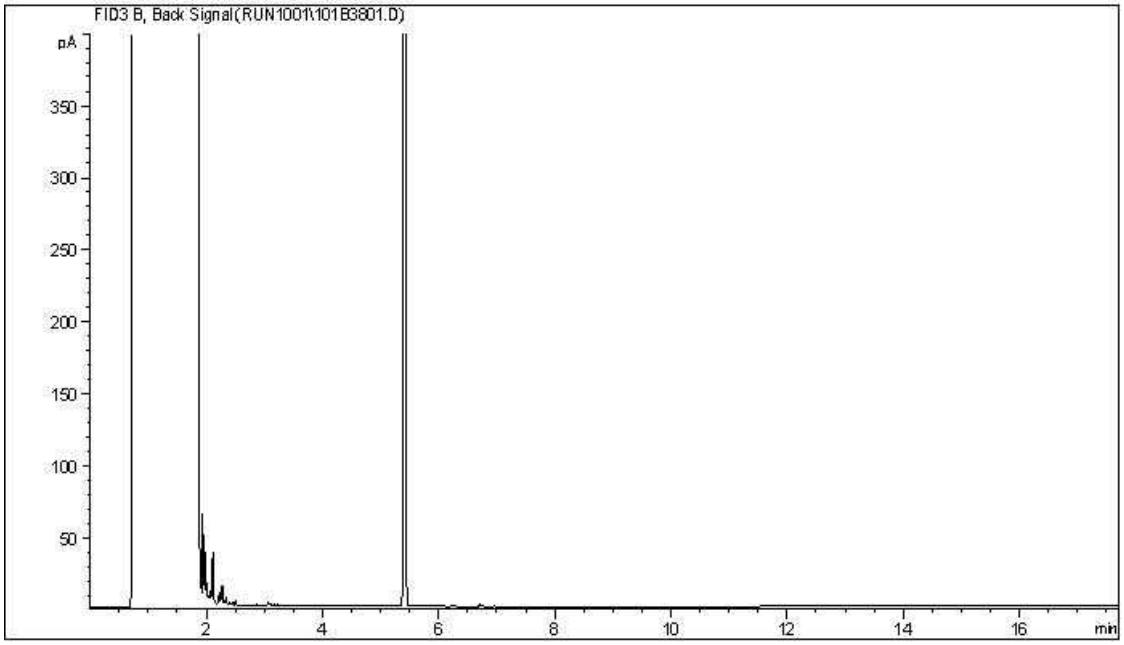
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0283

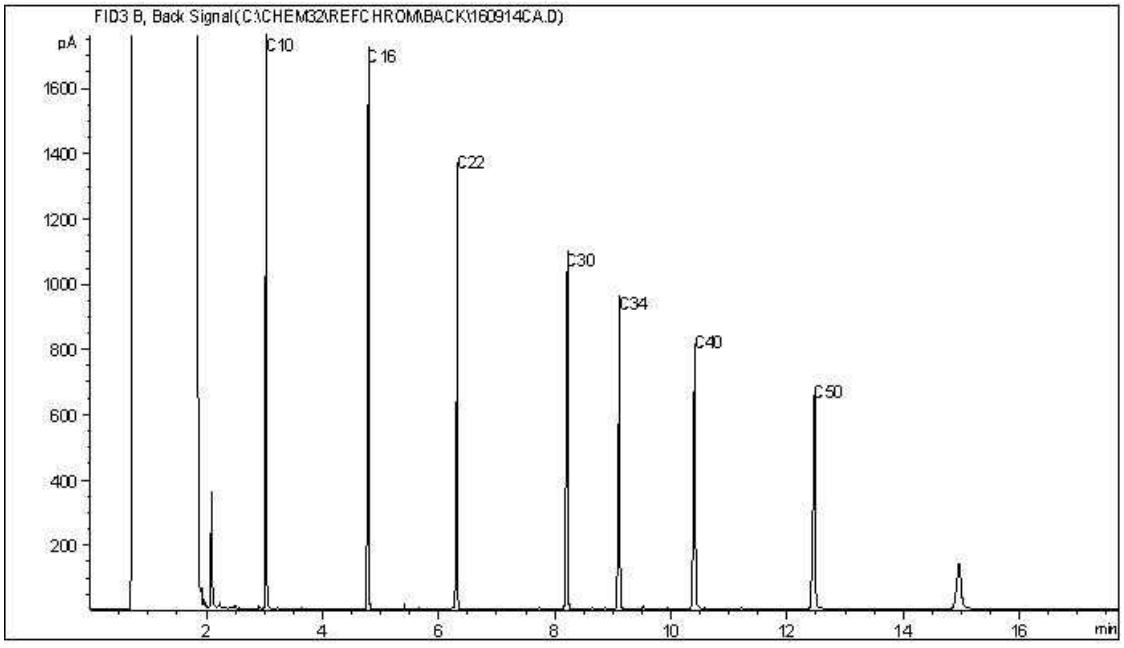
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-24-30

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

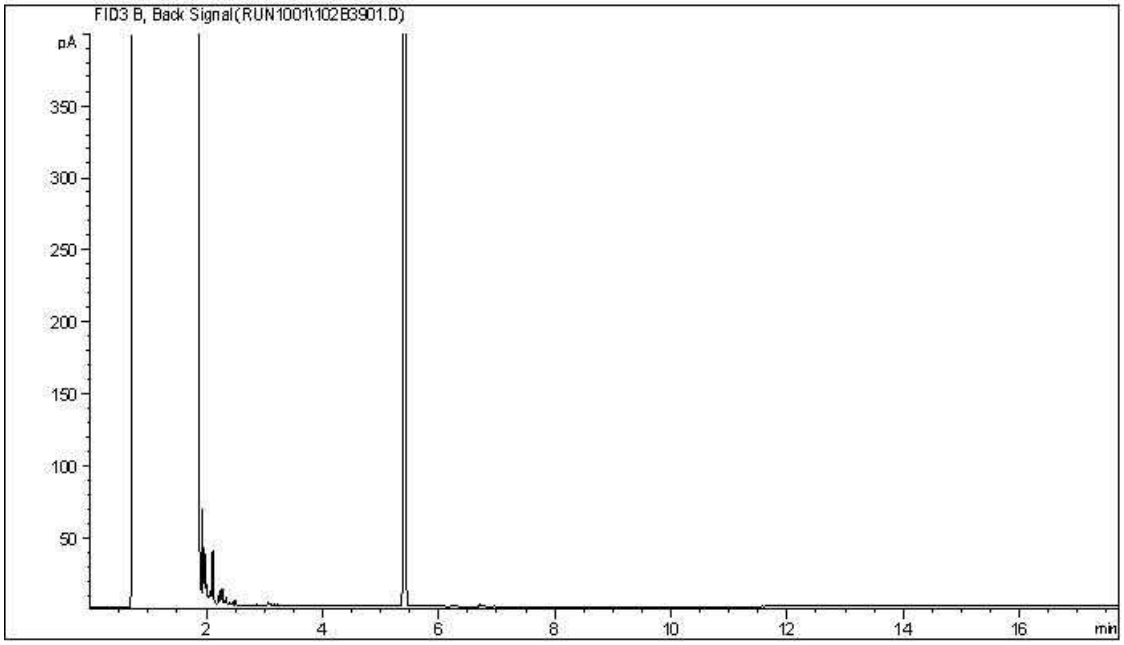
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0284

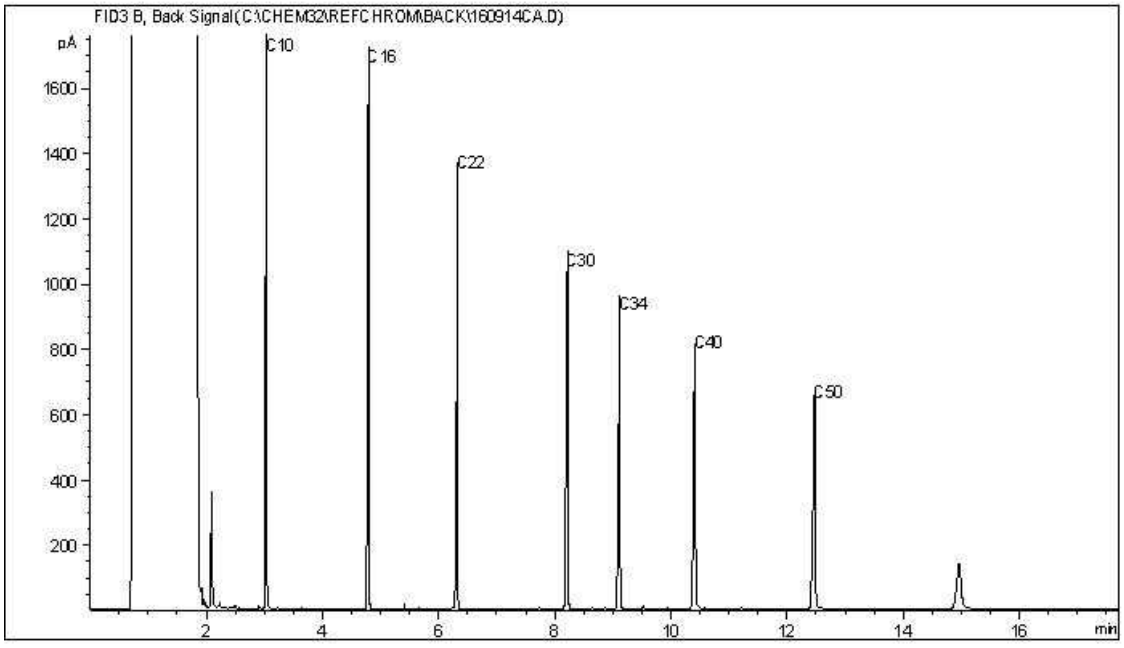
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-15-16

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

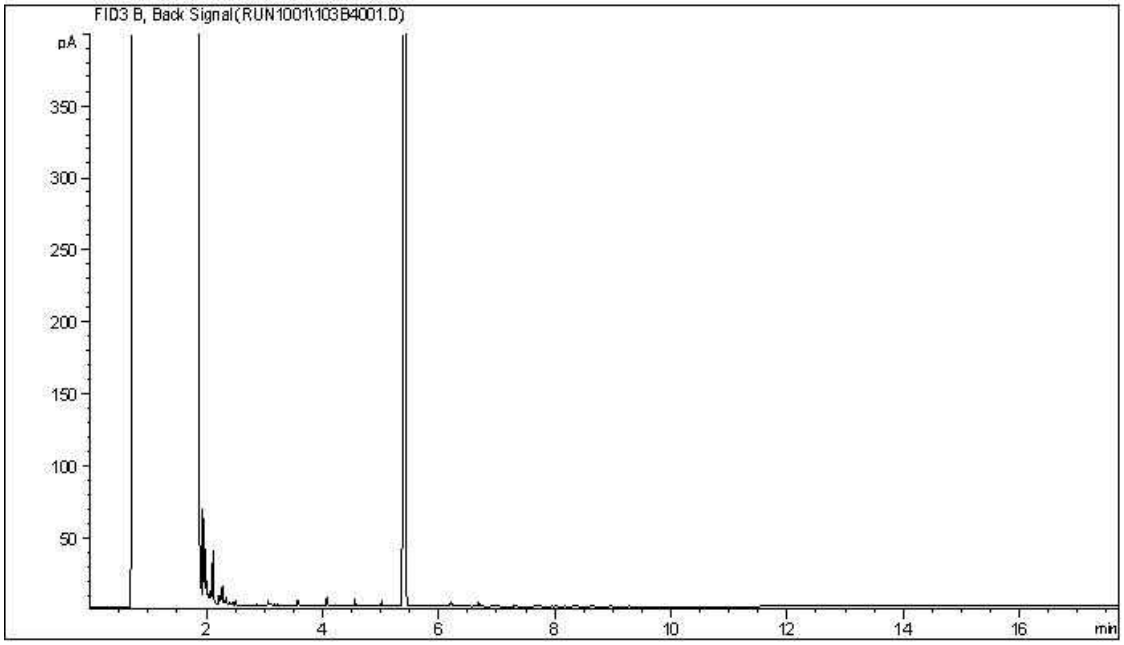
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0285

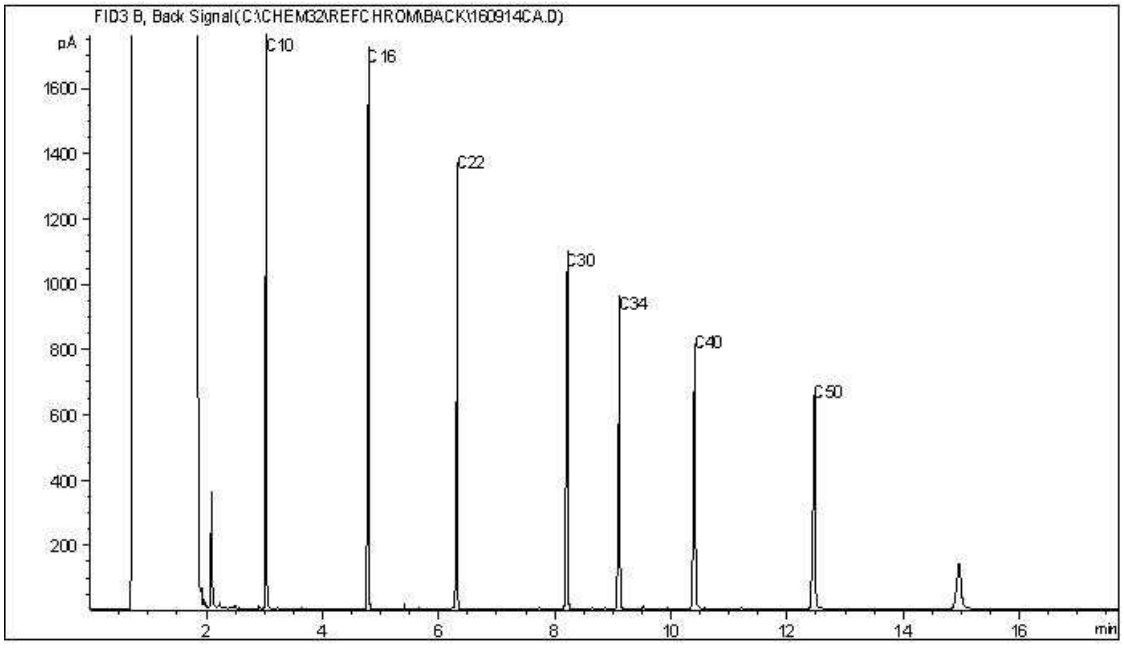
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-22-26

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Attachment D QA/QC DATA AND ANALYSIS

Groundwater Analytical QA/QC Results

Parameter	Units	RDL	MW16-04-20				MW16-24-30			
			Sample	Duplicate	RPD/AD		Sample	Duplicate	RPD/AD	
Anion Sum	meq/L	N/A	54	55	1.8	RPD	13	12	8.0	RPD
Cation Sum	meq/L	N/A	50	51	2.0	RPD	14	14	0.0	RPD
Hardness (as CaCO3)	mg/L	0.5	1700	1700	0.0	RPD	160	160	0.0	RPD
Ion Balance	none	0.01	0.94	0.94	0.0	RPD	1.1	1.1	0.0	RPD
Nitrate	mg/L	0.044	<0.044	0.045	<0.045	AD	<0.044	<0.044	<0.044	AD
Nitrate + Nitrite (as N)	mg/L	0.02	<0.020	<0.020	<0.020	AD	<0.020	<0.020	<0.020	AD
Nitrite	mg/L	0.033	<0.033	<0.033	<0.033	AD	<0.033	<0.033	<0.033	AD
Total Dissolved Solids	mg/L	10	3400	3400	0.0	RPD	730	720	1.4	RPD
Dissolved Organic Carbon (DOC)	mg/L	0.5	5.1	5.2	1.9	RPD	1.2	1.4	0.2	AD
Electrical Conductivity, Lab	µS/cm	1	4000	4000	0.0	RPD	1100	1100	0.0	RPD
pH	S.U.	N/A	7.52	7.45	0.9	RPD	8.19	8.18	0.1	RPD
BTEX and Petroleum Hydrocarbons										
Benzene	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Toluene	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Ethylbenzene	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Xylene, m & p-	mg/L	0.0008	<0.00080	<0.00080	<0.00080	AD	<0.00080	<0.00080	<0.00080	AD
Xylene, o-	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Xylenes, Total	mg/L	0.0008	<0.00080	<0.00080	<0.00080	AD	<0.00080	<0.00080	<0.00080	AD
PHC F1 (C6-C10 range)	mg/L	0.1	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
PHC F1 (C6-C10 range) minus BTEX	mg/L	0.1	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
PHC F2 (>C10-C16 range)	mg/L	0.1	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
Anions										
Alkalinity (P as CaCO3)	mg/L	0.5	<0.50	<0.50	<0.50	AD	<0.50	<0.50	<0.50	AD
Alkalinity, Total (as CaCO3)	mg/L	0.5	460	460	0.0	RPD	460	460	0	RPD
Alkalinity, Bicarbonate (as CaCO3)	mg/L	0.5	570	560	1.8	RPD	560	560	0	RPD
Alkalinity, Carbonate (as CaCO3)	mg/L	0.5	<0.50	<0.50	<0.50	AD	<0.50	<0.50	<0.50	AD
Alkalinity, Hydroxide (as CaCO3)	mg/L	0.5	<0.50	<0.50	<0.50	AD	<0.50	<0.50	<0.50	AD
Sulfate	mg/L	1.0	2100	2200	4.7	RPD	160	150	6.5	RPD
Chloride	mg/L	1.0	3.0	3.0	0.0	AD	<1.0	2.4	<2.4	AD
Nutrients										
Ammonia (as N)	mg/L	0.05	0.96	1.0	4.1	RPD	0.86	0.84	2.4	RPD
Nitrite (as N)	mg/L	0.010	<0.010	<0.010	<0.010	AD	<0.010	<0.010	<0.010	AD
Nitrate (as N)	mg/L	0.010	<0.010	0.010	<0.010	AD	<0.010	<0.010	<0.010	AD
Orthophosphate(as P)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	<0.0030	<0.0030	AD
Phosphorus, Total (Dissolved)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	0.0069	<0.069	AD
Total Kjeldahl Nitrogen	mg/L	0.05	1.1	1.1	0.0	RPD	0.88	0.81	8.3	RPD
Metals, Dissolved										
Aluminum	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	<0.0030	<0.0030	AD
Antimony	mg/L	0.00060	<0.00060	<0.00060	<0.00060	AD	<0.00060	<0.00060	<0.00060	AD
Arsenic	mg/L	0.0002	0.0017	0.0019	11.1		0.0023	0.0022	4.4	RPD
Barium	mg/L	0.010	<0.010	<0.010	<0.010	AD	0.019	0.018	0.001	AD
Beryllium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Boron	mg/L	0.02	0.11	0.11	0.0	RPD	0.089	0.089	0.0	AD
Cadmium	mg/L	0.000020	<0.000020	<0.000020	<0.000020	AD	<0.000020	<0.000020	<0.000020	AD
Calcium	mg/L	0.3	380	380	0.0	RPD	38	38	0.0	RPD
Chromium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Cobalt	mg/L	0.0003	0.00034	0.00031	0.00003	AD	<0.00030	<0.00030	<0.00030	AD
Copper	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Iron	mg/L	0.06	2.2	2.2	0.0	RPD	0.14	0.15	0.01	AD
Lead	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Lithium	mg/L	0.02	0.070	0.074	0.004	AD	0.054	0.053	0.001	AD
Magnesium	mg/L	0.2	180	180	0.0	RPD	16	15	6.5	RPD
Manganese	mg/L	0.004	0.60	0.60	0.0	RPD	0.067	0.066	1.5	RPD
Mercury	µg/L	0.0020	<0.0020	<0.0020	<0.0020	AD	<0.0020	<0.0020	<0.0020	AD
Molybdenum	mg/L	0.0002	0.0016	0.0015	6.5	RPD	0.0014	0.0015	6.9	RPD
Nickel	mg/L	0.00050	<0.00050	<0.00050	<0.00050	AD	<0.00050	<0.00050	<0.00050	AD
Phosphorus	mg/L	0.10	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
Potassium	mg/L	0.3	8.2	8.5	3.6	RPD	4.0	3.9	2.5	RPD
Selenium	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Silicon	mg/L	0.1	4.3	4.4	2.3	RPD	3.6	3.6	0.0	RPD
Silver	mg/L	0.00010	<0.00010	<0.00010	<0.00010	AD	<0.00010	<0.00010	<0.00010	AD
Sodium	mg/L	0.5	370	390	5.3	RPD	240	230	4.3	RPD
Strontium	mg/L	0.02	6.0	5.9	1.7	RPD	0.66	0.65	1.5	RPD
Sulfur	mg/L	0.2	730	720	1.4	RPD	51	50	2.0	RPD
Thallium	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Tin	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Titanium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Uranium	mg/L	0.0001	0.0023	0.0022	4.4	RPD	0.00022	0.00020	0.00002	AD
Vanadium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Zinc	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	<0.0030	<0.0030	AD
Metals, Total										
Mercury	µg/L	0.002-6	<2.0	<6.	<6	AD	<0.0020	<0.0020	<0.0020	AD
Microbiological Parameters										
Escherichia coli (E.Coli)	pn/100r	1-2	<2.0	<2.	<2	AD	<1.0	<1.0	<1	AD
Fecal Coliform	pn/100r	1-2	<2.0	<2.0	<2	AD	<1.0	<1.0	<1	AD
Heterotrophic Plate Count	cfu/mL	1	550	630	13.6	RPD	48	120	85.7	RPD
Total Coliforms	pn/100r	1-2	<2.0	<2.0	<2.0	AD	2.0	1.0	1	AD

RDL - Laboratory reportable detection limit

RPD - Relative Percent Difference

AD - Absolute Difference

Shaded RPD/AD values are outside of reproducibility criteria limits

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
Environmental Impact Assessment

Volume 4: Appendices
Appendix I: Hydrogeology

Groundwater Numerical Modelling Technical Data Report

Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

March 2018

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Abbreviations

ASTM	American Society for Testing and Materials
AWWID	Alberta Water Well Information Database
BTEX	benzene, toluene, ethylbenzene and xylenes
CALA	Canadian Association for Laboratory Accreditation
cfu/100 mL	colony forming units per 100 millilitre
CSA	Canadian Standards Association
DEM	digital elevation model
DOC	dissolved organic carbon
EC	electrical conductivity
GCDWQ	Guideline for Canadian Drinking Water Quality
GIS	geographic information system
GOWN	groundwater observation well network
HPC	heterotrophic plate count
mpn/100 mL	most probable number per 100 millilitres
m ASL	metres above sea level
m BGL	metres below ground level
PVC	polyvinyl chloride
QA/QC	quality assurance and quality control
TKN	total Kjeldahl nitrogen
3D CSM	three-dimensional conceptual site model

1.0 INTRODUCTION

This Technical Data Report (TDR) presents the numerical groundwater flow model that supports the Environmental Impact Study (EIS) for the proposed Springbank Off-stream Reservoir Project (the Project). Specifically, it supports, Section 5 in Volume 3A (construction and dry operations assessment) and Section 5 in Volume 3B (flood and post-flood assessment).

2.0 BACKGROUND

This report uses the following spatial boundaries, as are described in Volume 3A, Section 5 and Volume 3B, Section 5:

- project development area (PDA) is the immediate area of the physical disturbance associated with the project construction and operations
- local assessment area (LAA) is a 1,000 m buffer surrounding the PDA
- regional assessment area (RAA) is 14,000 ha and the Lateral extent of the RAA is bounded by:
  - a surface and shallow groundwater flow divide in the north
  - a boundary to the northwest to encompass the subwatershed of three small tributaries to the Elbow River
  - the floodplain and terrace of the Elbow River to the south
  - Jumpingpound Creek to the west which was used as the basis for defining the numerical model domain for groundwater modelling.

2.1 PHYSICAL SETTING AND TOPOGRAPHY

The Project is located in the Springbank area of Rocky View County in the Province of Alberta (Twp. 24. Rge. 04/03) W5M). The regional physiography is defined as sloping lower foothills and hummocky uplands, all of which is heavily dissected by intermittent streams. Till soils dominate the landscape with significant lacustrine materials in valleys defined by outcrops of the Brazeau, Coalspur and Paskapoo bedrock formations. Quaternary soils are predominantly black chernozems, some dark grey chernozems while wetlands are mainly gleysols.

Aspen forests dominate the sub-region but are largely absent in the PDA, while stands of conifers are present in the Elbow River floodplain. Some areas of dense tall willow are in lowlands and northerly slopes, while grasslands dominate the natural landscape and are more common on southerly slopes.

The ground surface topography of the RAA is depicted by the digital elevation model (DEM) presented in Figure 2-1. Areas of higher elevation are denoted by red, grading down to areas of relatively low elevation denoted as blue. The topographic elevation ranges from approximately 1,354 m ASL on the bedrock ridges in the southwest corner of the RAA to approximately 1,126 m ASL along the Elbow River at the eastern boundary.

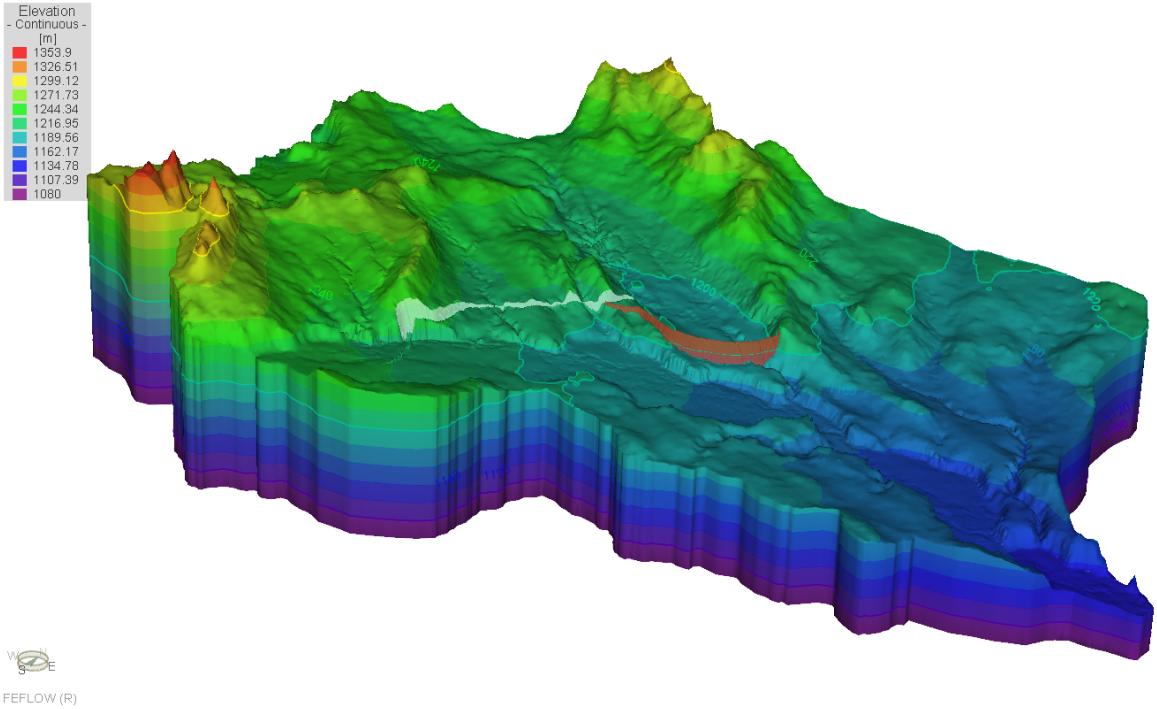


Figure 2-1 Topography of the RAA with Dam (orange) and Diversion Channel (hatched white)

2.2 CLIMATE

The climate in the region is semi-arid, and is characterized by relatively long cold winters and hot, dry summers. The mean daily temperature varies from -8.2°C in January to 14.8°C in July, with a mean annual daily temperature of 3.1°C. The average annual precipitation is 469 mm, of which 366 mm is in the form of rainfall. June has the highest average rainfall of 106.7 mm.

Volume 3A, Section 6 (Hydrology) discussed evaporation in the study area. Evaporation data are not available for the Springbank Airport. However, data obtained at the Calgary International Airport suggests that shallow lake evaporation and potential evaporation average 728 mm and 992 mm annually, respectively (AESRD 2013). Highest evaporation rates occur in July with a potential shallow lake evaporation of 154 mm (AESRD 2013).

2.3 HYDROGEOLOGIC SETTING

The generalized stratigraphic framework beneath the RAA is described in the Hydrogeology Baseline TDR (Volume 4, Appendix I) and is presented in Figure 2-2. More detailed descriptions of each of the stratigraphic units along with discussion of the additional salient features of the hydrostratigraphic framework are presented in the Hydrogeology Baseline TDR.

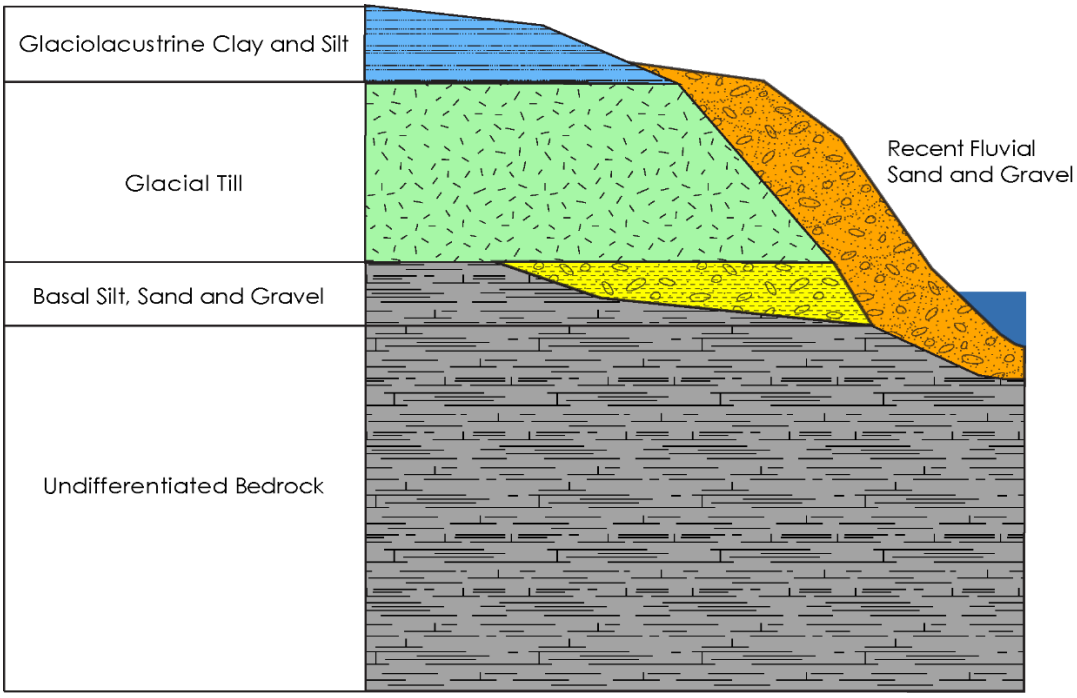
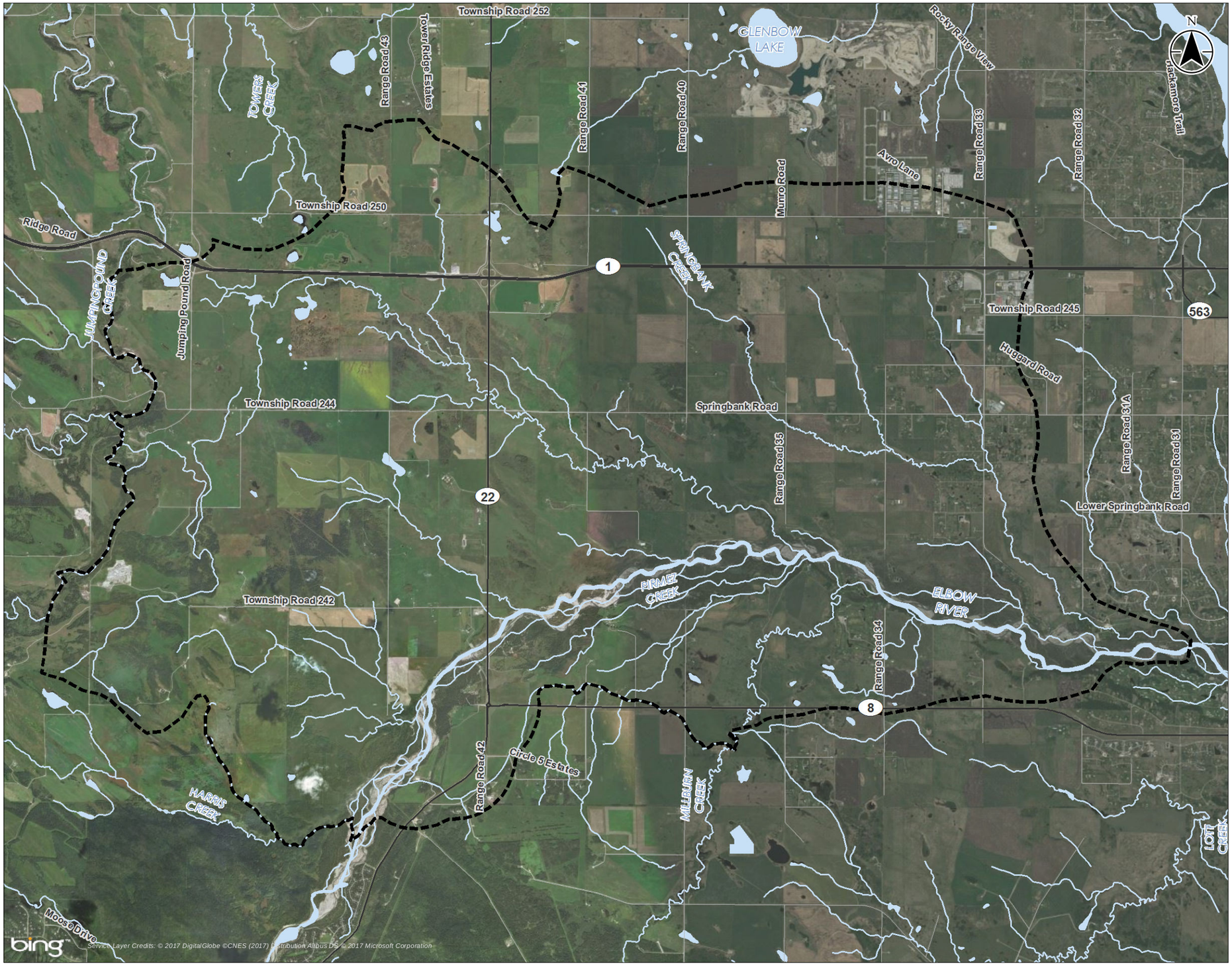


Figure 2-2 Regional Stratigraphic Column

The numerical groundwater modeling study presented in this report is based on the hydrostratigraphic framework described for the RAA in the Hydrogeology Baseline TDR. The model is based on the review, compilation, and analysis of existing hydrological and hydrogeological information as well as new hydrogeological data (see the Hydrogeology Baseline TDR).

2.3.1 Groundwater Model Domain

The RAA is bounded by a surface and shallow groundwater flow divide in the north, an arbitrary boundary to the northwest to encompass the sub-watershed of three small tributaries to the Elbow River, the floodplain and terrace of the Elbow River to the south and Jumpingpound Creek to the west. The perimeter boundaries are presented in plan view in Figure 2-3. The vertical boundaries are defined by the ground surface as the uppermost surface and an arbitrary lower surface at an elevation of 1,080 m ASL.



Stantec

Project Data
- Model Domain

Landbase
- Major Road
- Minor Road
- Watercourse
- Waterbody

0 1 2 Kilometres

1:65,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 3TM 114.
2. Base features courtesy of Geogratis and CANVEC.
3. Orthoimagery: Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.

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Prepared by AC on 2017-11-20
Technical Review by MB on 2017-11-20

Client/Project
ALBERTA TRANSPORTATION
Springbank Off-Stream Reservoir Project
Environmental Impact Assessment

Figure No.
2-3

Title
Groundwater Model Domain

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3.0 FROM A CONCEPTUAL MODEL TO A NUMERICAL FLOW MODEL

3.1 MODELLING APPROACH

The numerical model is required to evaluate potential changes to the hydrogeologic system caused by floods and construction and operation of the Project. A numerical model represents the groundwater flow through a saturated porous media (in this case, unconsolidated and bedrock materials), considering the hydraulic properties, subsurface geologic materials and associated physical parameters that govern the flow within the porous media.

A numerical flow model based on finite element method (FEM) was selected over other potential analytical and numerical methods (e.g. finite difference and finite volume) due to the large size of the RAA, complex geologic framework, time-variable boundary conditions, and irregular geometry of the physiographic setting and project components. A numerical solution technique minimizes the number of simplifying assumptions that would be required using other analytical methods, thus yielding a more detailed depiction of the hydrogeologic setting and system response within the RAA.

The finite element subsurface flow and transport system (FEFLOW) is a numerical groundwater modelling system that is capable of modelling three-dimensional (3D) groundwater flow and mass transport. FEFLOW was selected to simulate the groundwater flow because it is a well-documented, well-tested proprietary code capable of advanced simulation of regional and local groundwater systems due to its ability to simulate time-varying boundary conditions with variable mesh resolution within an irregular model domain.

A detailed description of the code is provided by DHI (2016). FEFLOW also includes a public programming interface for incorporation of user defined code. All parts of the FEFLOW code have passed an extensive benchmarking process, where simulated results are compared to those of other well-known simulation systems, analytical solutions or to observations from lab experiments whenever possible. The results of numerous benchmark tests are published in the WASY GmbH (2005) and DHI (2016) documentation, along with a detailed description of the corresponding model setups and an extensive discussion of the results.

3.2 HYDROSTRATIGRAPHIC FRAMEWORK

The lateral and vertical distribution of the hydrostratigraphic units are shown in 3D in Figure 3-1, which was extracted from the FEFLOW interface. Figure 3-2 presents an oblique angle view of the 3D conceptual model sliced through the model domain from southwest to northeast. The grey unit in Figure 3-2 represents undifferentiated bedrock material. The unconsolidated deposits above the bedrock are as follows:

- basal silt, sand and gravel (not visible in the figures)
- Till (depicted in purple in Figure 3-1 and green in Figure 3-2)
- glaciolacustrine clay (depicted in blue in Figure 3-1 and Figure 3-2)
- recent fluvial sand and gravel (depicted in red in Figure 3-1 and orange in Figure 3-2)

Further details regarding the hydrostratigraphic units present within the RAA (and model domain) is described in the Hydrogeology Baseline TDR (Volume 4, Appendix I).

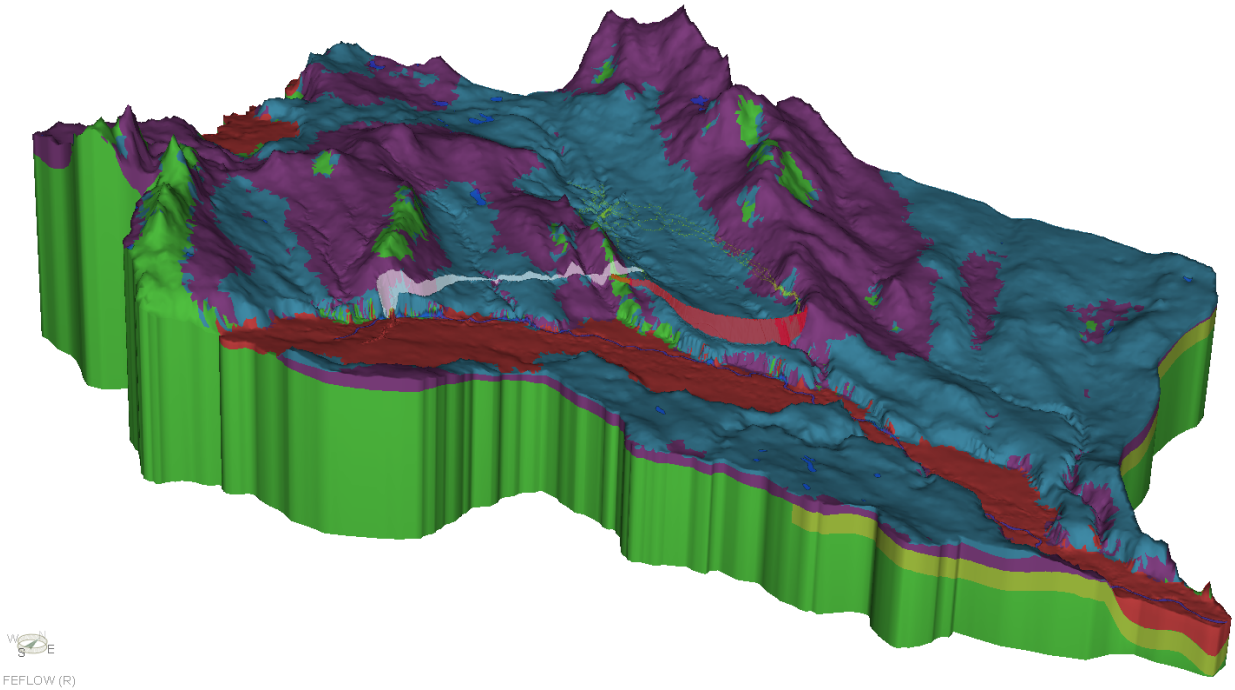

Figure 3-1 Oblique Angle View of the Numerical Flow Model Domain and Hydrostratigraphic Units

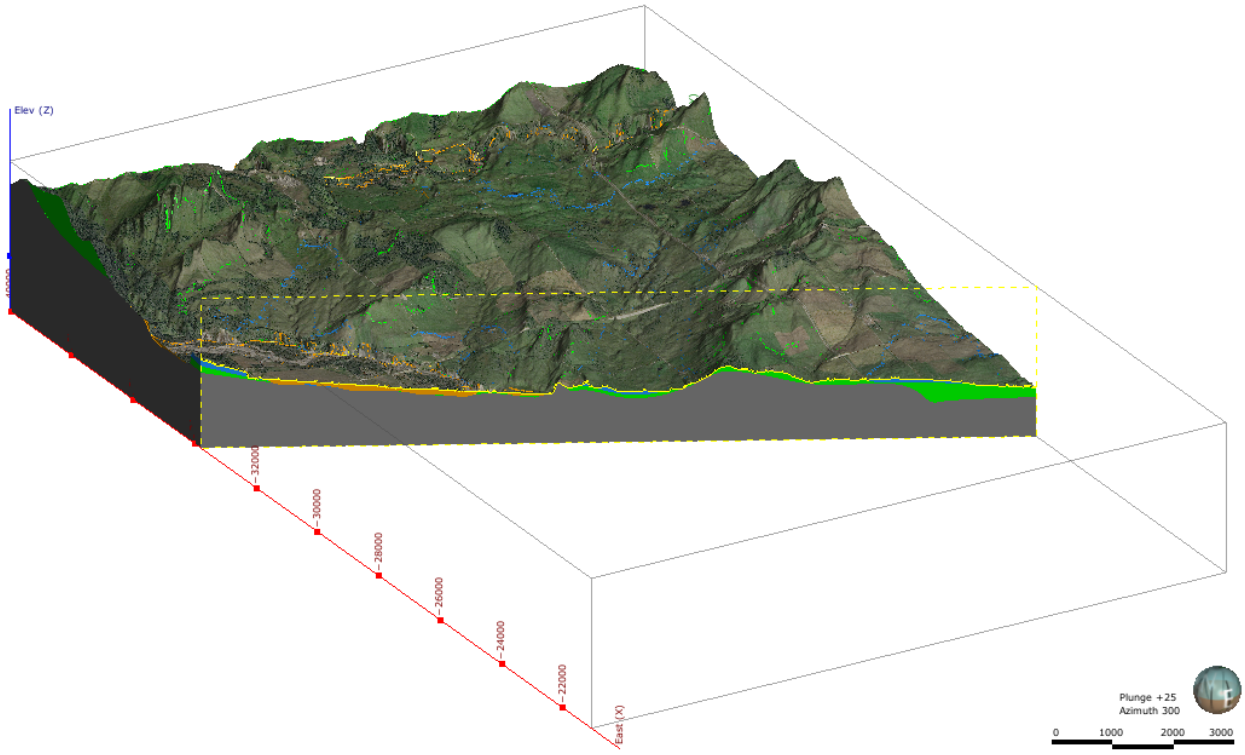

Figure 3-2 Southwest-Northeast Slice Through the 3D Hydrostratigraphic Model

3.2.1 Preliminary Parameterization of Hydraulic Conductivity

The preliminary hydraulic conductivity values for each of the hydrostratigraphic units present in the numerical model were obtained from the response test analyses presented in the Hydrogeology Baseline TDR (Volume 4, Appendix I). These field-based estimates were used as initial hydraulic conductivity values for the model calibration. A summary of the preliminary hydraulic conductivity estimates is presented Table 3-1.

Table 3-1 Well Response Test Hydraulic Conductivity Estimates

Well Name	Completion Depth (m BGL)	Completion Lithology	Estimated Hydraulic Conductivity (m/s)		
			Hvorslev (1951)	KGS (Hyder et. al. 1994)	Bouwer-Rice (1976)
MW16-1-15	15.2	Sandstone	1.2E-06	2.3E-06	
MW16-4-22	21.6	Sandstone	8.8E-07	1.9E-06	
MW16-6-20	21.9	Claystone/Siltstone	2.8E-09	3.8E-09	
MW16-8-19	18.6	Sandstone	6.3E-07	2.2E-06	
MW16-9-6	5.8	Glaciolacustrine clay and silt	5.3E-08	2.2E-07	
MW16-10-15	15.2	Till	2.5E-10	6.3E-10	
MW16-18-10	10.6	Claystone	4.2E-06	9.6E-06	
MW16-19-19	18.6	Sandstone	3.1E-06	9.2E-06	
MW16-24-30	30.5	Sandstone	1.5E-05		
MW16-25-9	9.1	Till	2.4E-10		8.2E-10

Figure 3-3 presents spatial distribution of hydraulic conductivities for the first (uppermost) model layer. Cross-sections AA', BB' and CC' present the vertical distribution of the hydraulic conductivities for each of the hydrostratigraphic units (Figure 3-4 to Figure 3-6). The locations of each cross section within the model domain are shown in Figure 3-3.

The hydraulic conductivities were the initial values for the hydraulic conductivities assigned to layers within the numerical model; they were subsequently adjusted during model calibration (see Section 5.0).

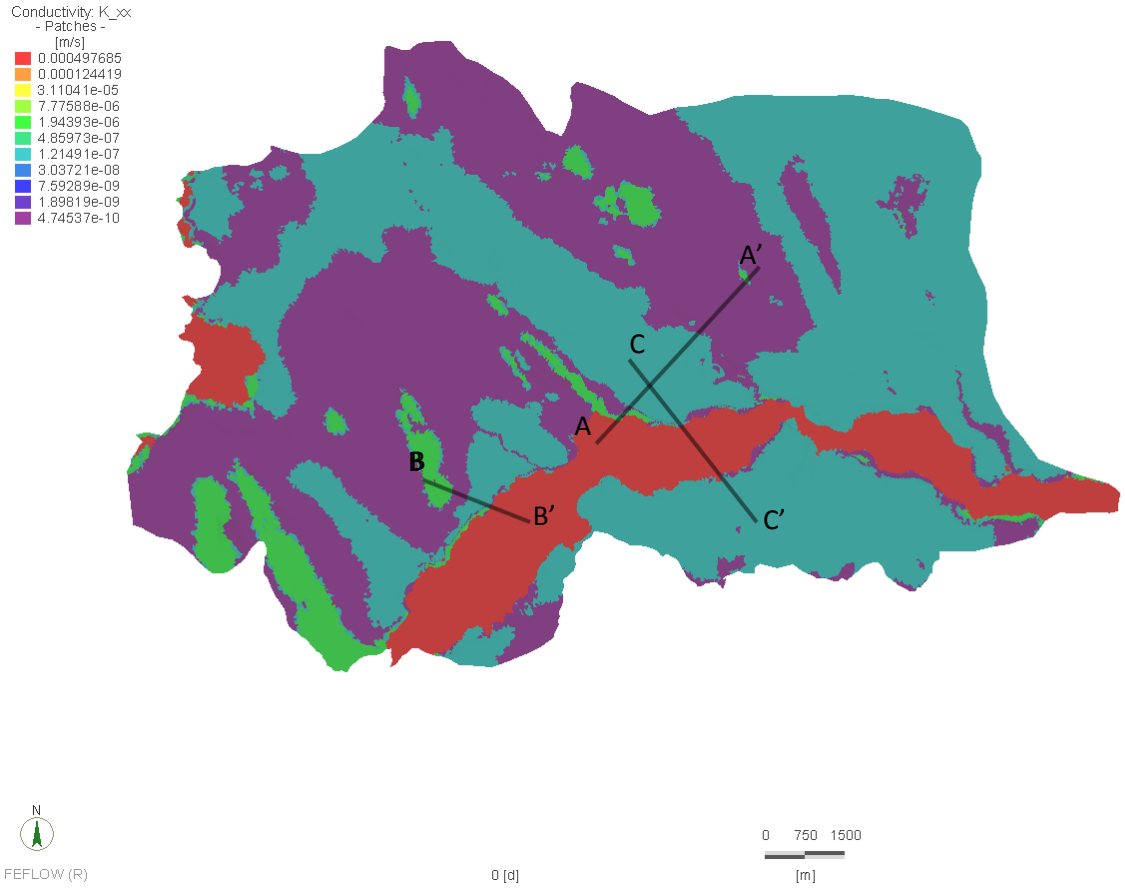

Figure 3-3 Aerial View of the Model Domain and Cross-Section Locations

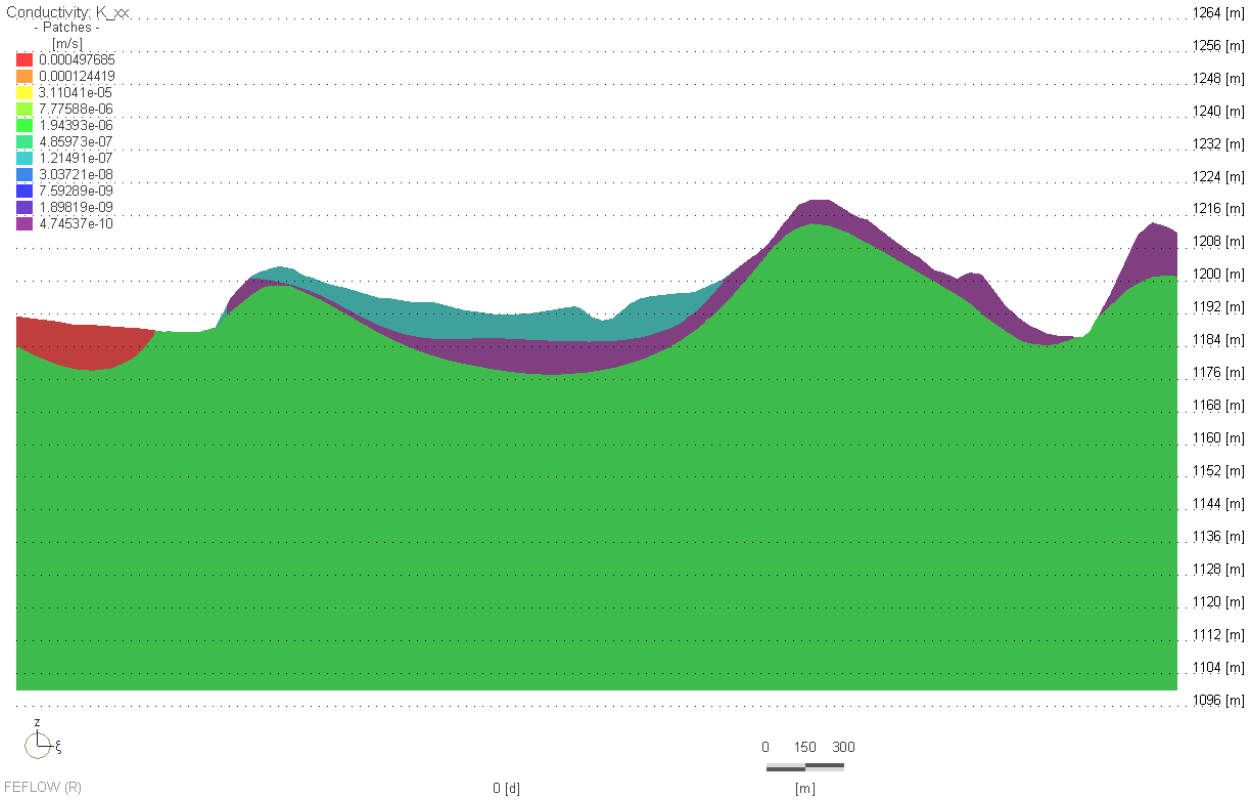

Figure 3-4 Cross-Section A-A' Showing Hydraulic Conductivities.

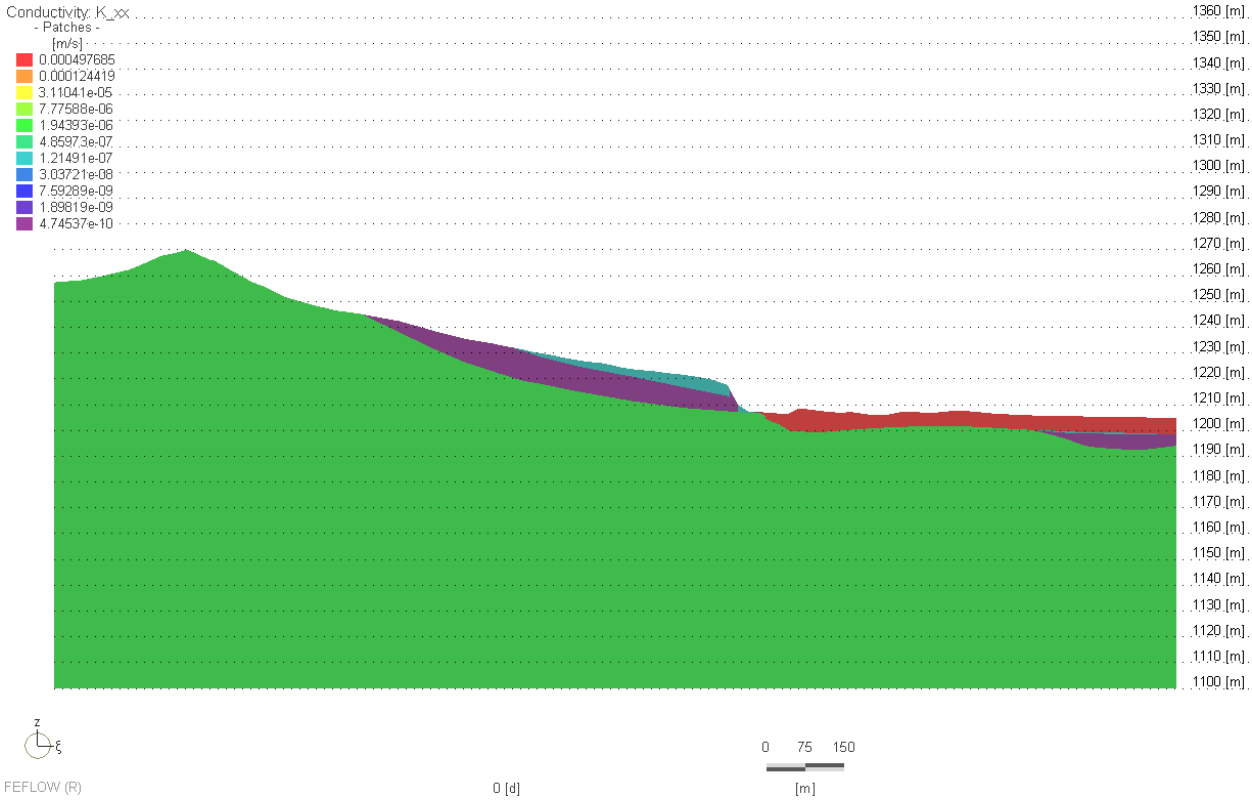

Figure 3-5 Cross-Section B-B' Showing Hydraulic Conductivities

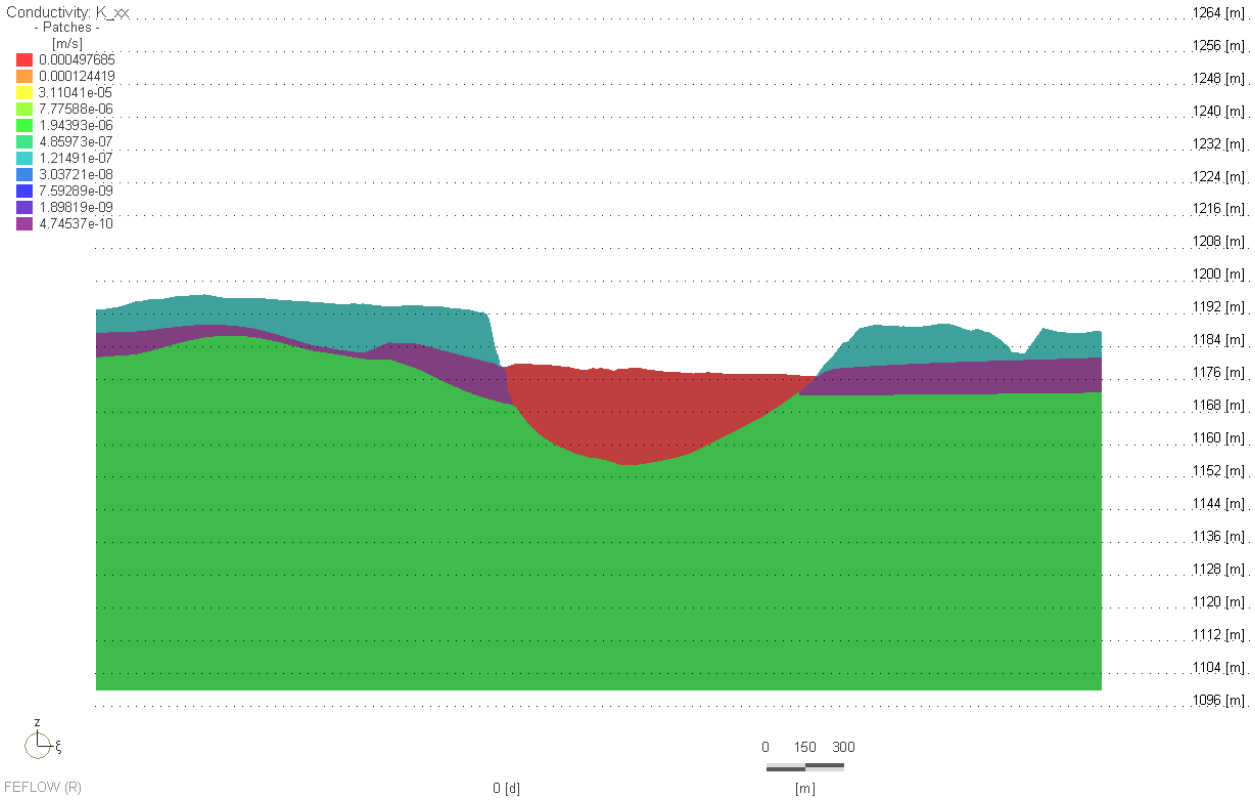

Figure 3-6 Cross-Section C-C' Showing Hydraulic Conductivities

3.2.2 Initial Potentiometric Head

The potentiometric surface of the upper water table, found within unconsolidated surficial deposits is presented in the Hydrogeology Baseline TDR (Volume 4, Appendix I). Groundwater elevations within the surficial geologic layer generally follow the topography and range from 0 m below ground surface (BGL) to approximately 8.0 m BGL. These groundwater elevations were used as initial hydraulic heads during calibration of the numerical model. Temporal changes in groundwater levels were evaluated using data logging pressure transducers installed at 10 monitoring wells within the RAA. Hydrographs from October 7, 2016 to May 24, 2017 are presented in the Hydrogeology Baseline TDR.

4.0 NUMERICAL MODEL CONSTRUCTION

The numerical model domain was based on the stratigraphic interpretations described within the 3D CSM. The geologic units represented in the 3D CSM were exported into the FEFLOW model domain through export of 3D surfaces representing the various contact surfaces between units. A finite element supermesh was created in the FEFLOW user interface, and this supermesh was exported to the 3D CSM such that elevations of the various stratigraphic units could be exported at each of the supermesh nodes. This process was repeated for each of the stratigraphic units in the groundwater model domain. In this manner, the overall hydrogeologic framework of the 3D CSM is maintained within FEFLOW model.

Once the model domain was discretized, boundary conditions were set and parameterization of the domain was completed using hydraulic conductivity testing results which helped to constrain the calibration. Calibration of the model then proceeded using a combination of heads measured in monitoring wells situated within the LAA, heads measured in domestic wells situated in the RAA, and other information regarding surface water elevations in both the LAA and RAA. Calibration of the model at steady state conditions used a combination of parameter estimation routines implemented by FePEST until a reasonable fit between observed and simulated steady state heads was observed. Additional manual calibrations in transient simulations were also completed to refine the model's dynamic response.

4.1 MESH DISTRIBUTION

The numerical model domain was discretized into reasonably small elements and a mesh was generated with enhanced resolution that was required for assessing the effect of floods on the groundwater system in the area. The mesh generation involved the following three steps:

1. creating a "supermesh" from a defined model domain map, incorporating all the geometric information required for the 3D groundwater flow model
2. generating a 2D mesh of the topographic extent of the area modeled
3. expanding the 2D mesh into a multi-layer 3D mesh that provides an accurate representation of the model domain

The supermesh is comprised of polygons, lines, and points. The following GIS layers were used as input for the supermesh:

- proposed dam, diversion channel, and flood berm
- topography from the regional digital elevation model (DEM) and LiDAR data
- surface water courses
- surface water bodies

The numerical model boundaries were selected to coincide with the watershed boundaries where possible. All boundaries were selected to extend sufficiently far from the proposed off-stream reservoir, dam and diversion channel to prevent unwanted interactions of the model boundaries with the area of interest (i.e., "boundary effects"). The model mesh was refined with a higher density of nodes near the diversion channel, off-stream reservoir, and dam (Figure 4-1), as well as near existing water courses (e.g. Elbow River and its tributaries, as shown on Figure 4-2 and Figure 4-3).

The final 3D mesh constructed for the model domain has 1,702,640 nodes and 2,973,831 triangular elements. The number of elements was minimized to the extent possible, to balance the numerical accuracy of the model with the computational effort required. The aspect ratio (the ratio of maximum to minimum element dimensions) was assigned to be small so that computed flow directions are not subject to large errors, as is advocated by Anderson and Woessner (1992) and Istok (1989).

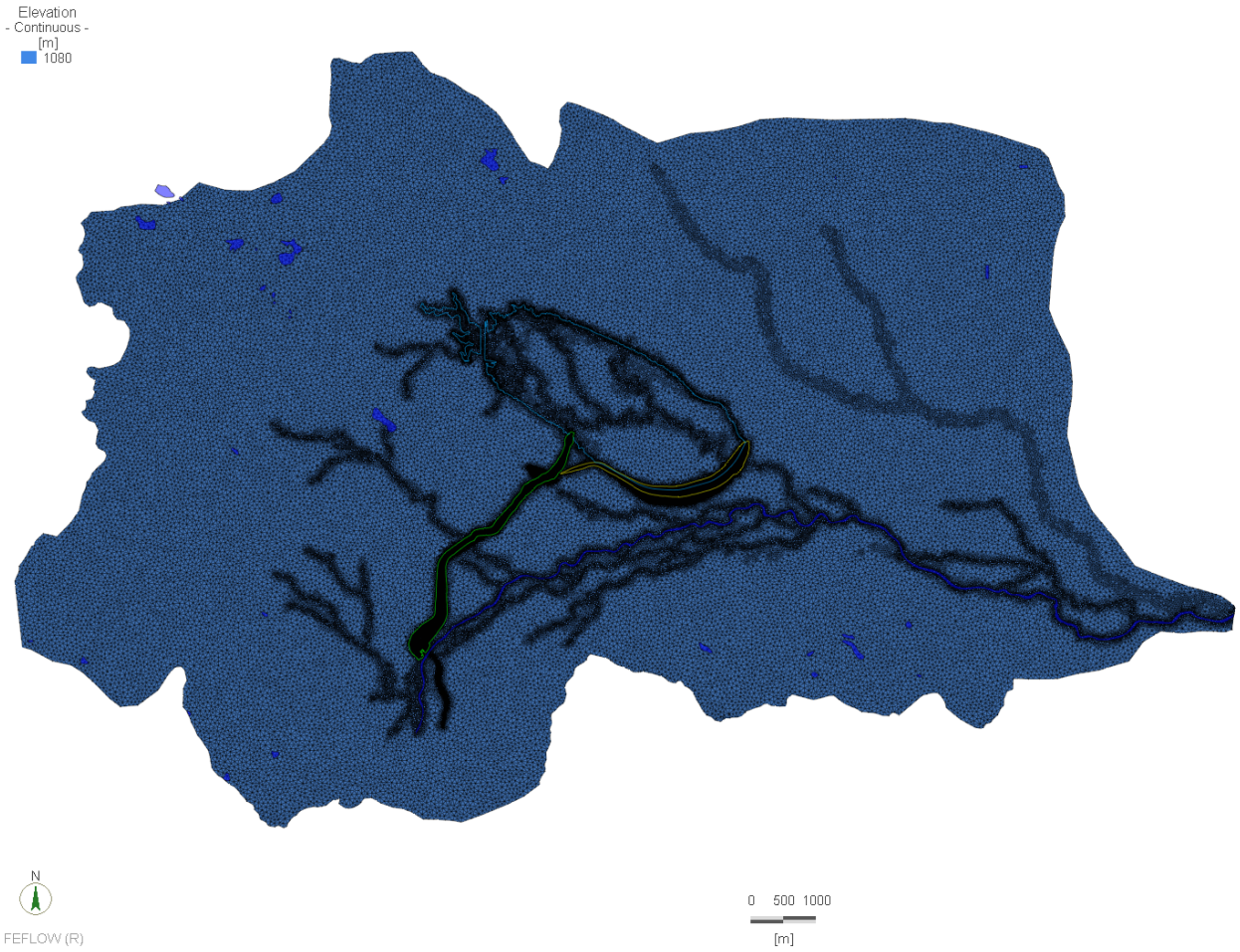

Figure 4-1 Mesh Distribution with Higher Density along Surface Water Features.

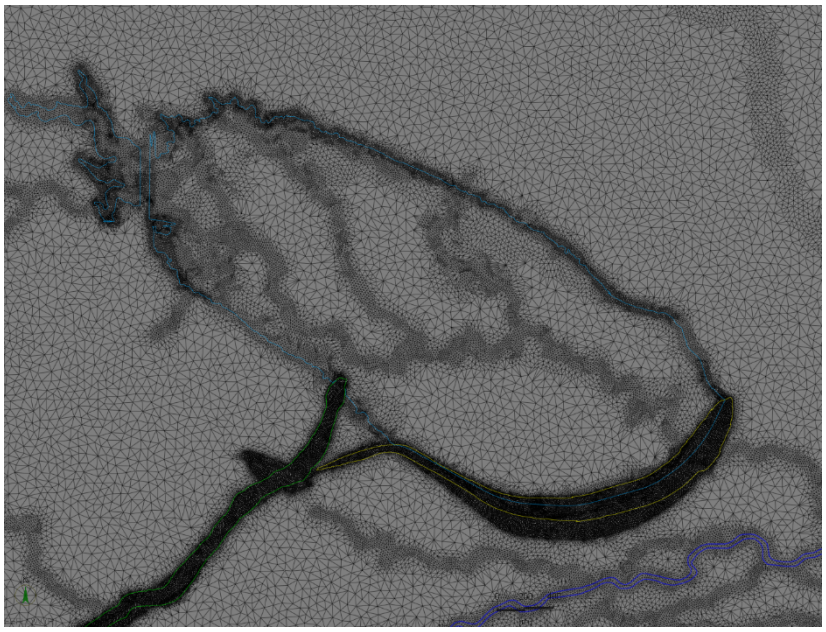

Figure 4-2 Refined Mesh in Vicinity of Flooded Area

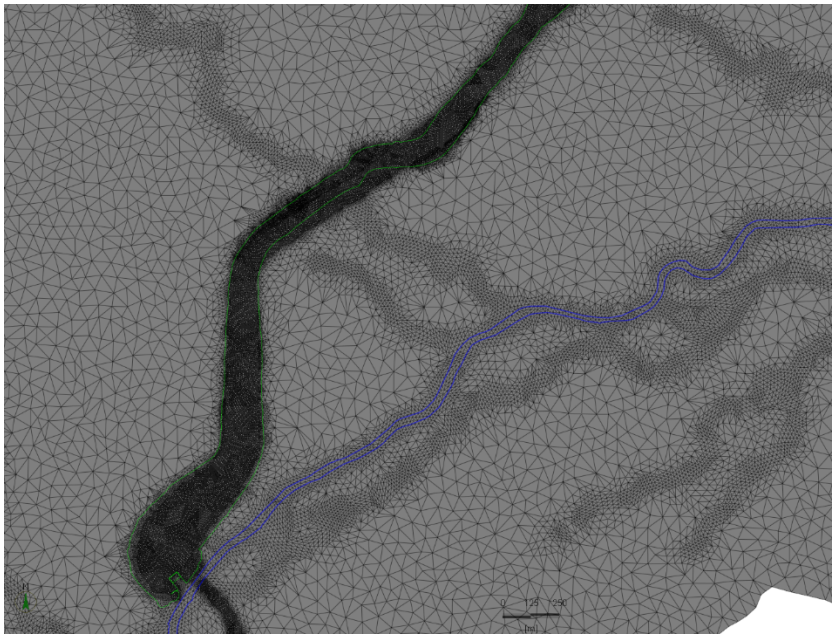

Figure 4-3 Refined Mesh along Diversion Channel and Elbow River

4.2 NUMERICAL MODEL BOUNDARY CONDITIONS

Prescribed head and prescribed flux boundary conditions were specified to the model perimeter as described in the following subsections. Unless otherwise specified, the edges along northwest of the model domain were assigned a no-flow boundary condition. Distributed groundwater recharge was not applied to the model domain. As discussed in Section 2.3, the annual evapotranspiration rate exceeds the annual precipitation rate, meaning there is minimal groundwater recharge from precipitation. Time varying river water level boundary conditions along Elbow River, at the diversion channel and off-stream reservoir were applied to assess response of groundwater system to three floods.

4.2.1 Prescribed Head Boundaries

Prescribed head boundaries, Dirchilet boundaries, were specified to the top layer of the model domain to represent surface water boundaries, and at the perimeter of the model domain. As shown on Figure 4-4, the heads were assigned to surface water features in the domain, based on the elevation of the features determined from the digital elevation model (DEM). Additional prescribed head nodes were assigned to the perimeter of the model domain to represent the static water level at the model boundary, and they were also assigned based on the elevation of the nodes extracted from the DEM.

Figure 4-6 to Figure 4-14 present time varying river water level boundary conditions used in the model for the design flood for both the existing environment (EE1, if there were not a Project) and design flood (PP1, Project in operation). The time varying surface water level hydrographs were obtained from the hydrodynamic modeling results (Volume 4. Appendix H). Figure 4-5 also shows the points along the Elbow river and near the diversion channel inlet where the time-dependent hydraulic boundary condition hydrographs were extracted.

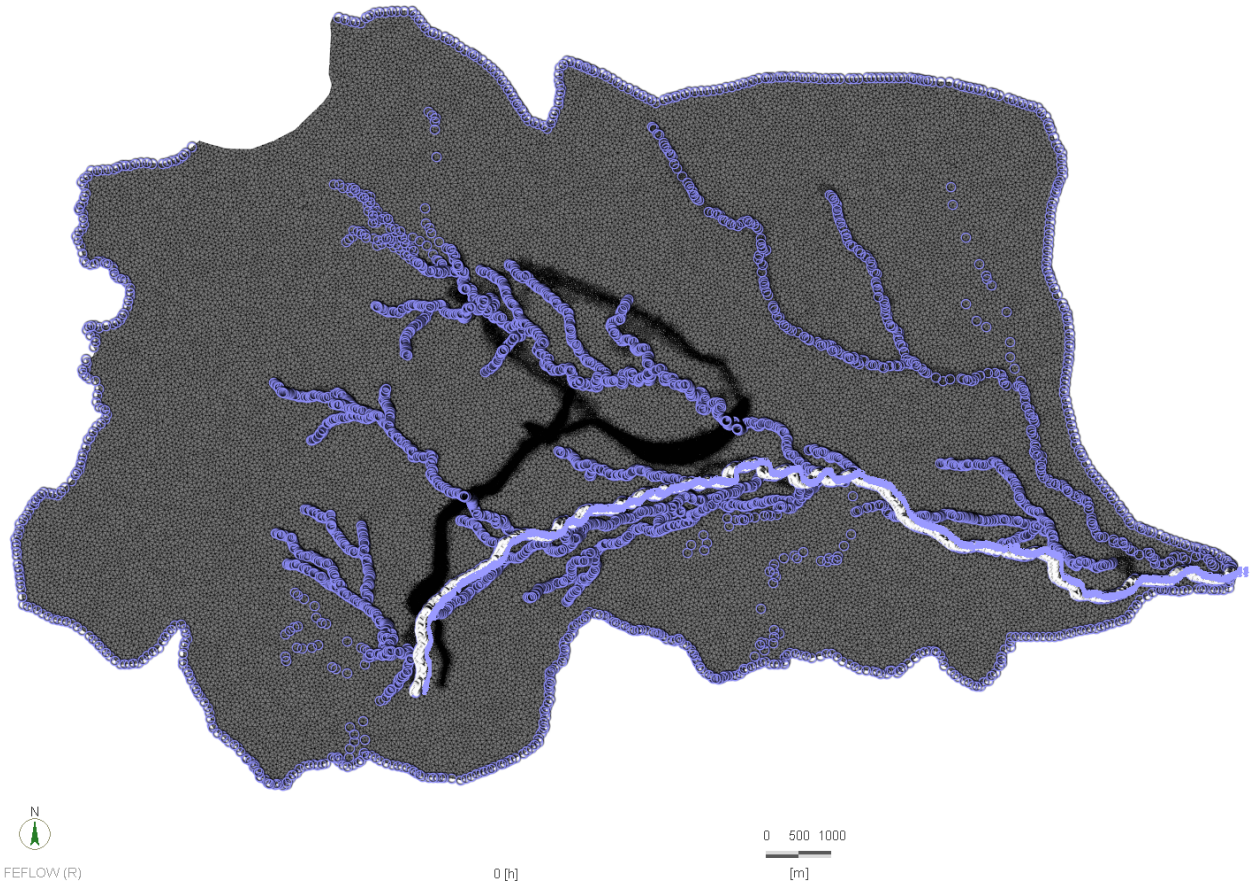

Figure 4-4 Locations of Prescribed Head Boundary Conditions in Model Domain

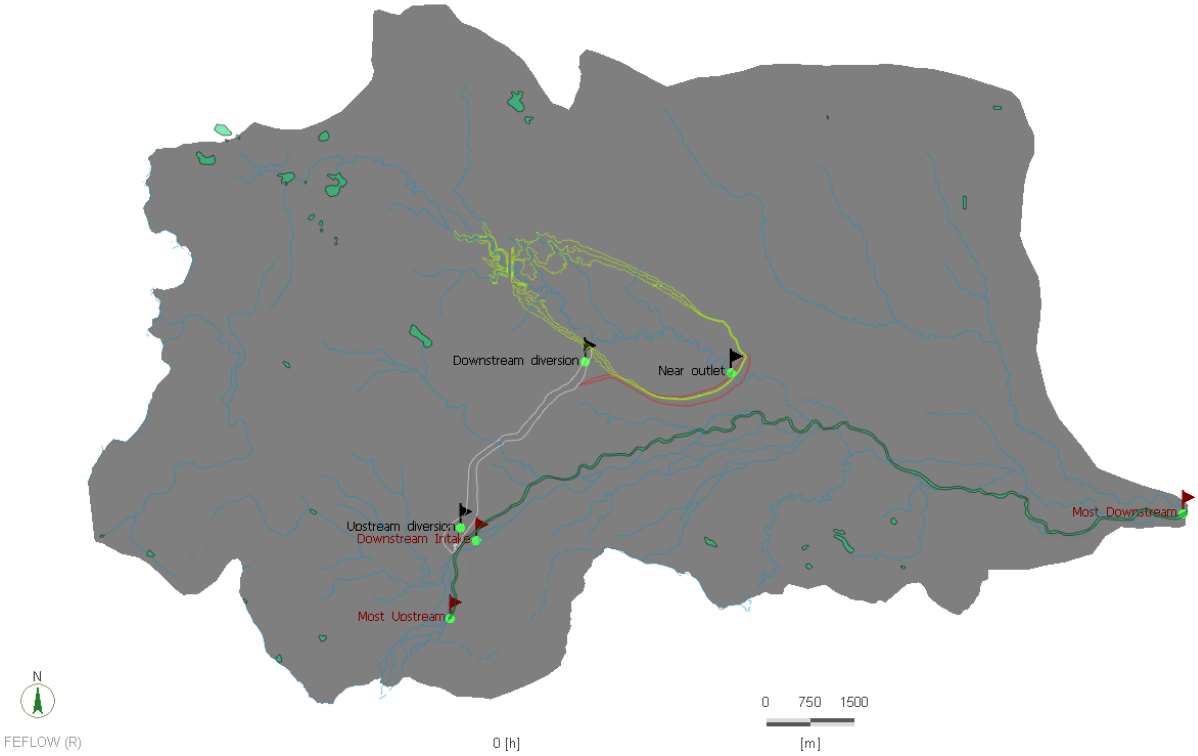

Figure 4-5 Location-Extracted Hydrographs for Time-Varying Boundary Conditions

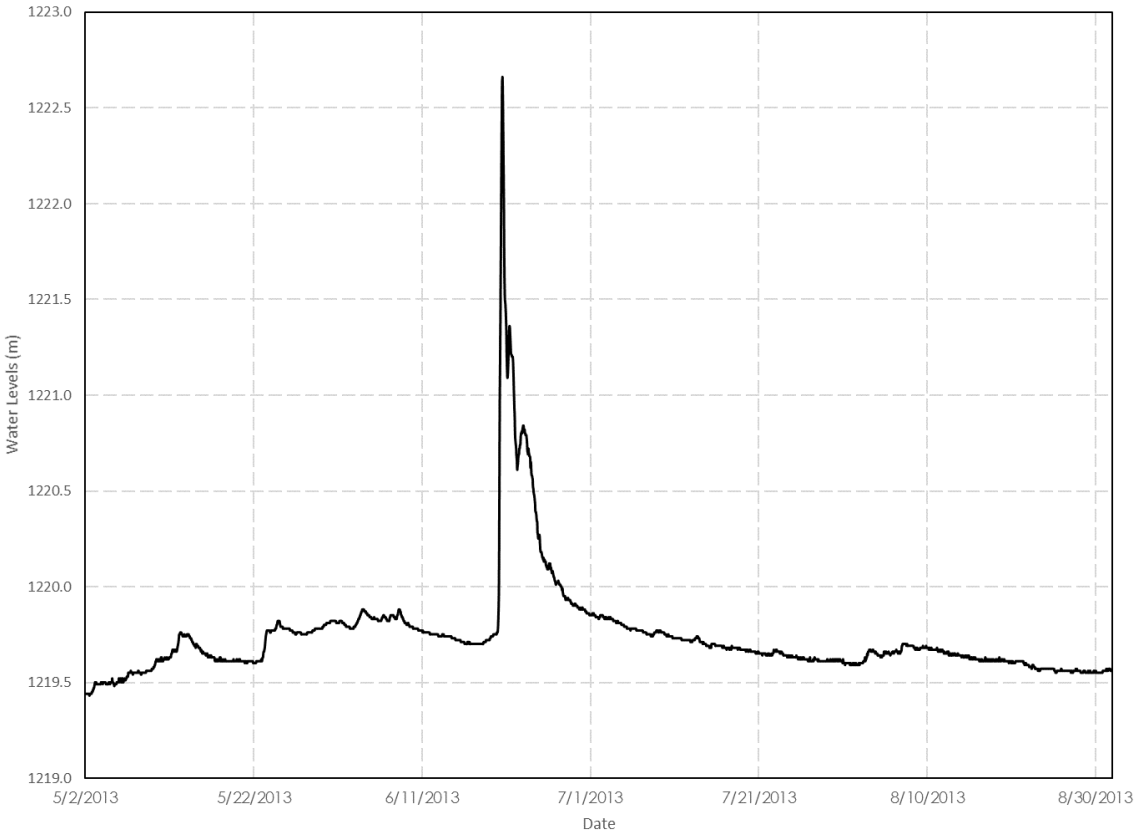

Figure 4-6 **Simulated Water Level Boundary Condition Hydrograph (EE1, Design Flood if there were no Project) at the Most Upstream Point along Elbow River**

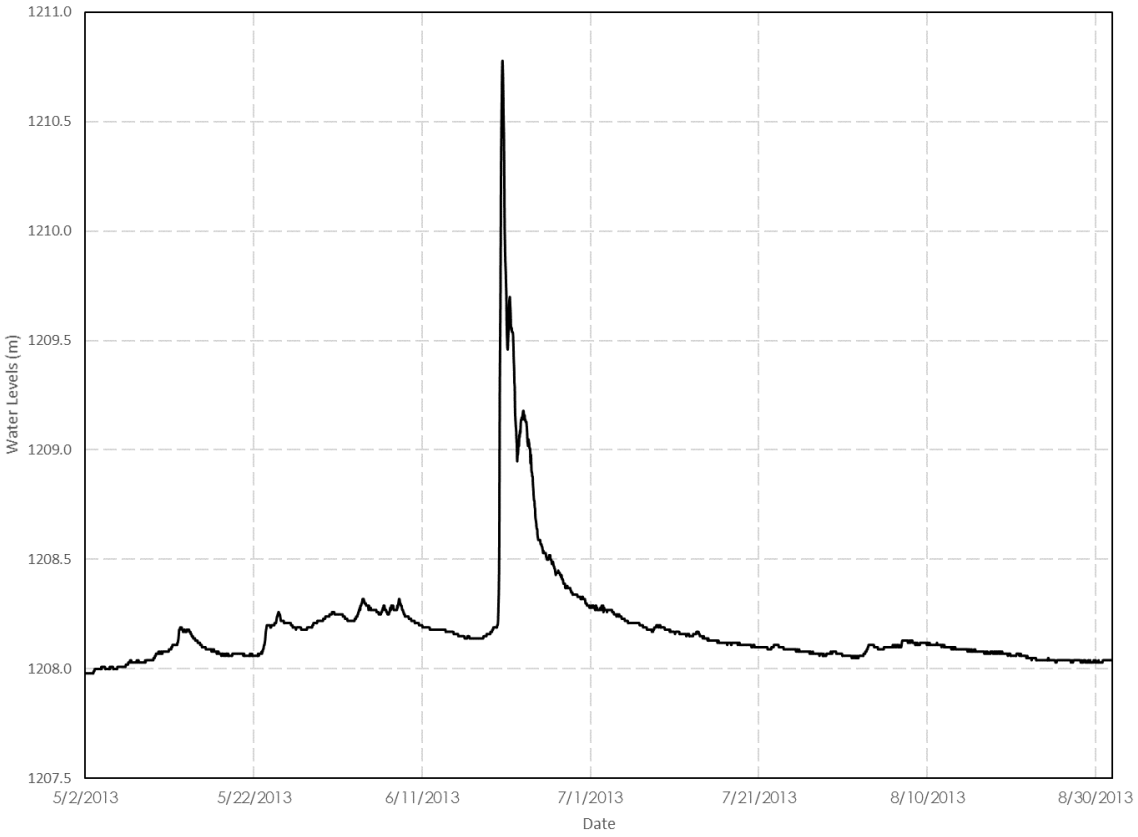

Figure 4-7 Simulated Water Level Boundary Condition Hydrograph (EE1, Design Flood if there were no Project) along Elbow River Downstream of the Intake

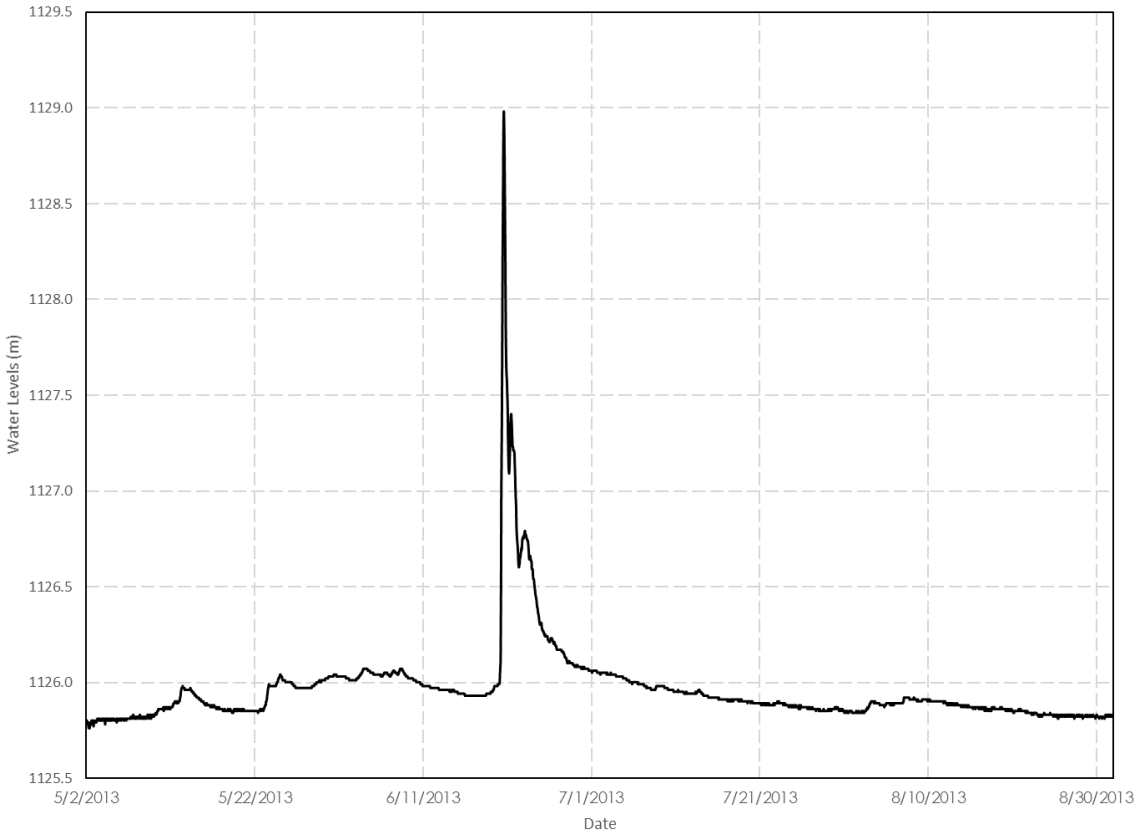

Figure 4-8 **Simulated Water Level Boundary Condition Hydrograph (EE1, Design Flood if there were no Project) at the Most Downstream Point along Elbow River**

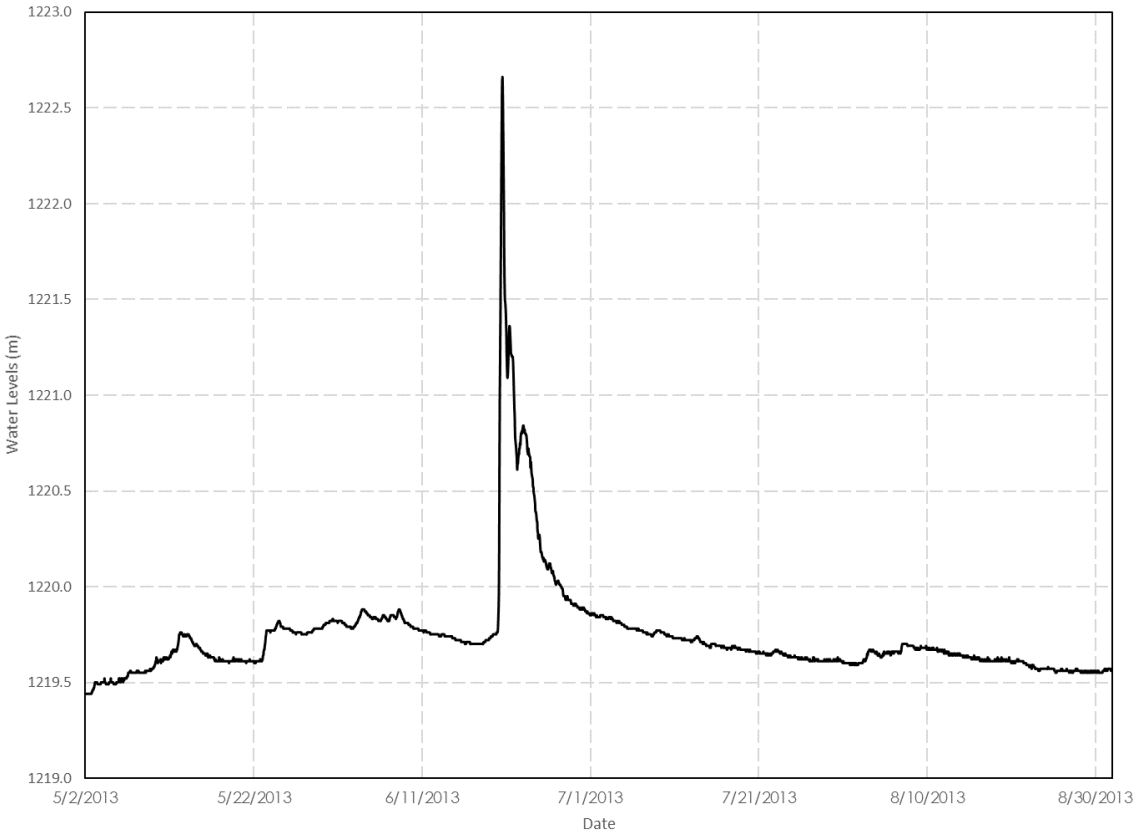

Figure 4-9 **Simulated Water Level Boundary Condition Hydrograph (PP1, Design Flood with the Project in Operation) at the Most Upstream point along Elbow River**

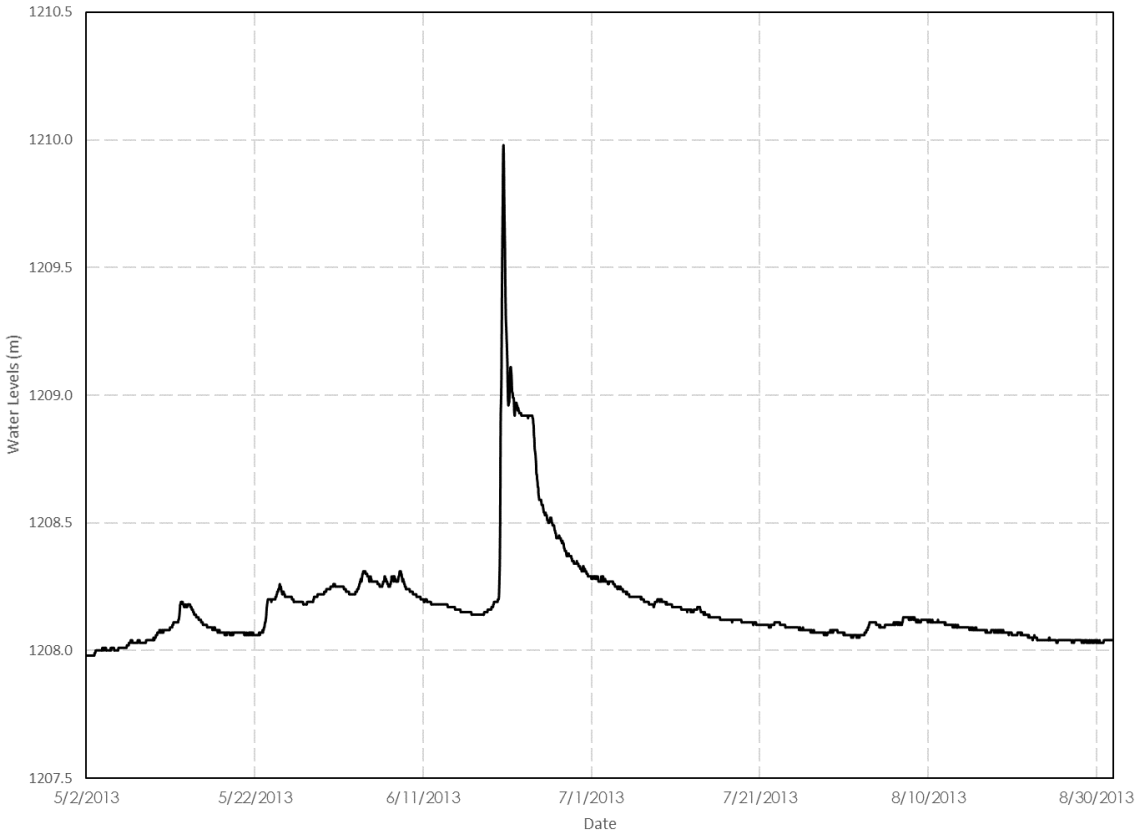

Figure 4-10 Simulated Water Level Boundary Condition Hydrograph (PP1, Design Flood with the Project in Operation) along Elbow River Downstream of the Intake

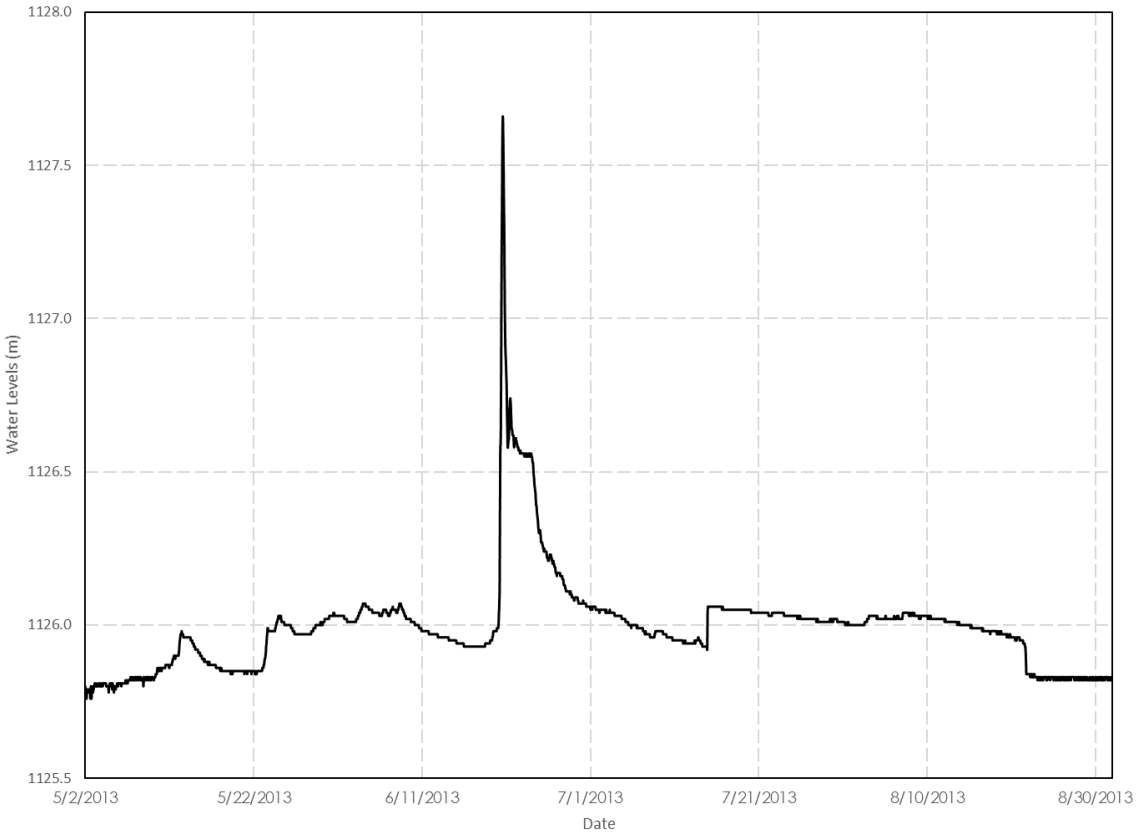

Figure 4-11 Simulated Water Level Boundary Condition Hydrograph (PP1, Design Flood with the Project in Operation) at the Most Downstream Point along Elbow River

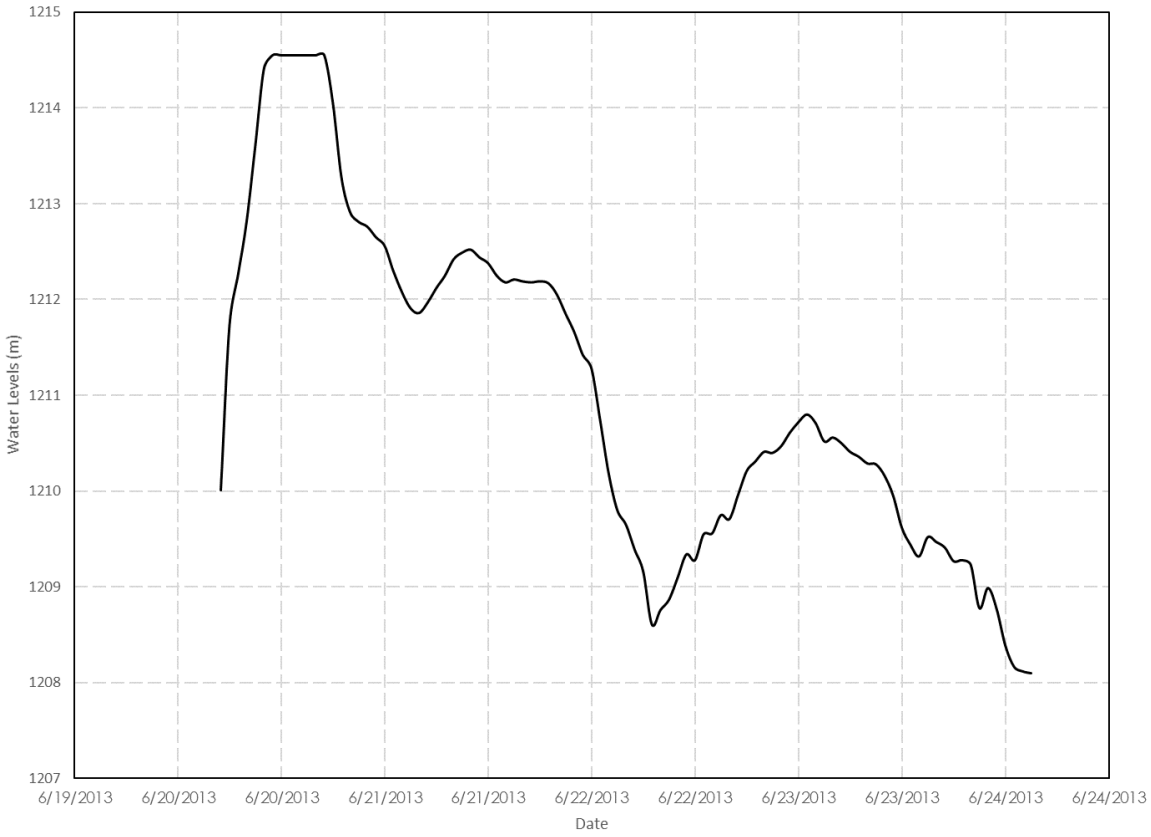

Figure 4-12 Simulated Water Level Boundary Condition Hydrograph (PP1, Design Flood with the Project in Operation) at Upstream Point along Diversion Channel

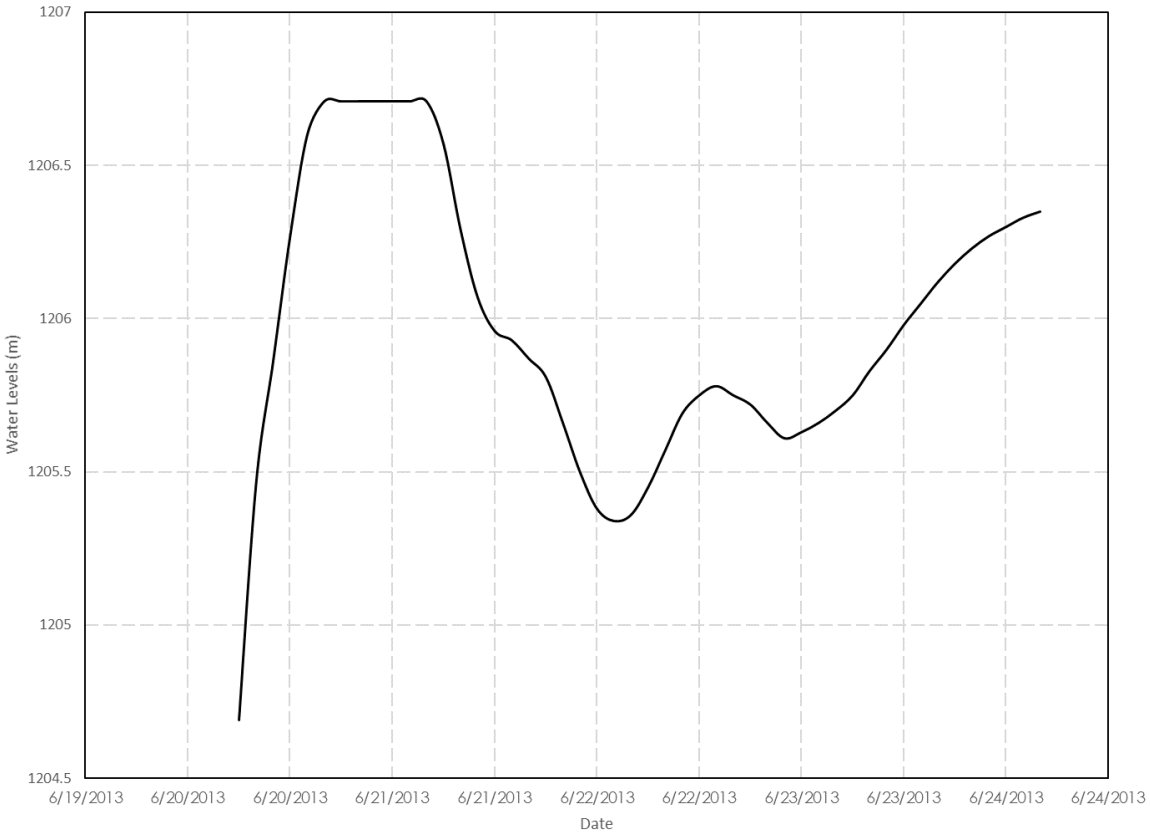

Figure 4-13 Simulated Water Level Boundary Condition Hydrograph (PP1, Design Flood with the Project in Operation) at Downstream Point along the Diversion Channel

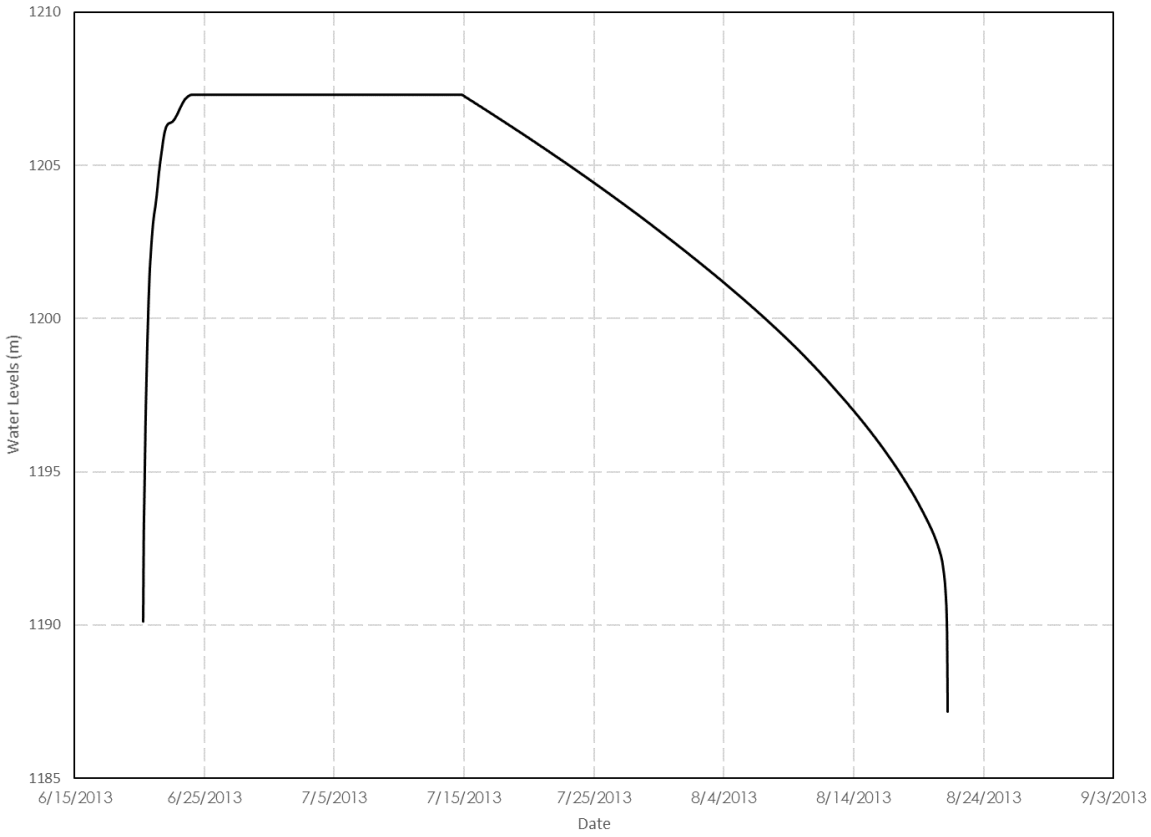

Figure 4-14 Simulated Water Level Boundary Condition Hydrograph (PP1, Design Flood with the Project in Operation) near the Diversion Channel Outlet

4.2.2 Prescribed Flux Boundaries

Fluid-flux boundaries, Neumann boundaries, were used to represent inflows and outflows for saturated aquifers in the model domain. These boundaries were applied where aquifer units intersected the edge of the model domain, to simulate more regional groundwater inflows and outflows in these units. The location of the prescribed-flux boundaries is presented on Figure 4-15.

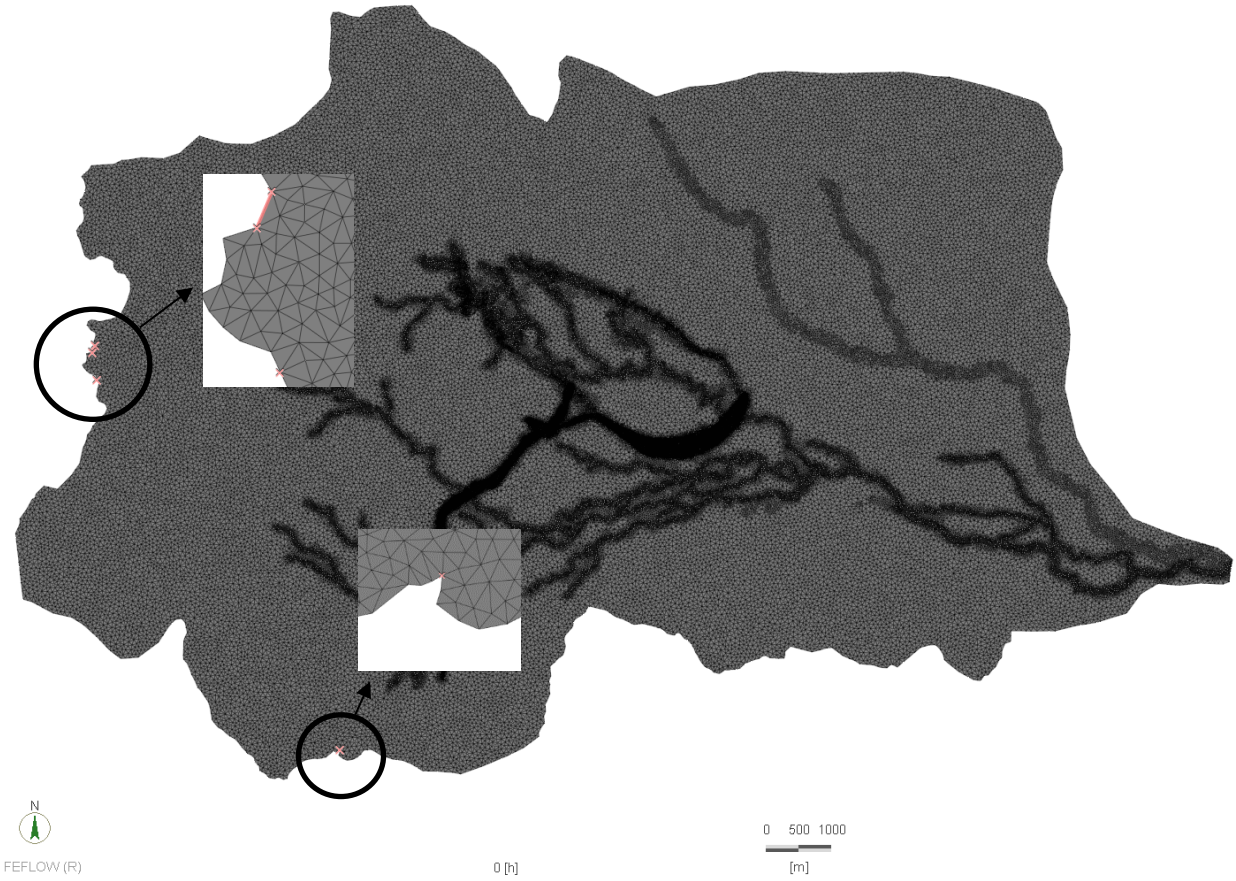

Figure 4-15 Prescribed Flux Locations in the Top Three Layers of the Model

5.0 MODEL CALIBRATION

The numerical model was first calibrated to represent steady-state groundwater conditions. The steady-state assumption is considered valid because the measured groundwater level fluctuations between October 2016 to May 2017 are minimal, relative to the overall magnitude of variation across the RAA.

Prior to numerical model calibration, the range of uncertainty in the parameters contained within the conceptual hydrogeologic model was evaluated. Model calibration was conducted using an iterative approach where a flow simulation was carried out. The resulting groundwater heads were compared to observed heads, and the model input parameters were adjusted to achieve better agreement with observed (field measured head) conditions. This process was partially automated using the parameter estimation software FEPEST.

5.1 SPECIFICATION OF CALIBRATION TARGETS

5.1.1 Quantitative Criteria

Groundwater level data were compiled from the water well database records and the 2016/2017 field work detailed in the Hydrogeology Baseline TDR (Volume 4, Appendix I). The compiled dataset contains groundwater level observations collected in the LAA between October 2016 and May 2017 which were selected as calibration targets. One monitoring well (MW16-11-15) was removed from the calibration dataset because the water level elevation was much higher than surrounding observations in the water well database records and it was thought to be representative of a local perched aquifer, rather than being representative of the regional water table.

The spatial distribution of the monitoring well water level points that were used for model calibration is shown on Figure 5-1. Additional domestic well records were also considered during the model calibration within the broader RAA (not shown).

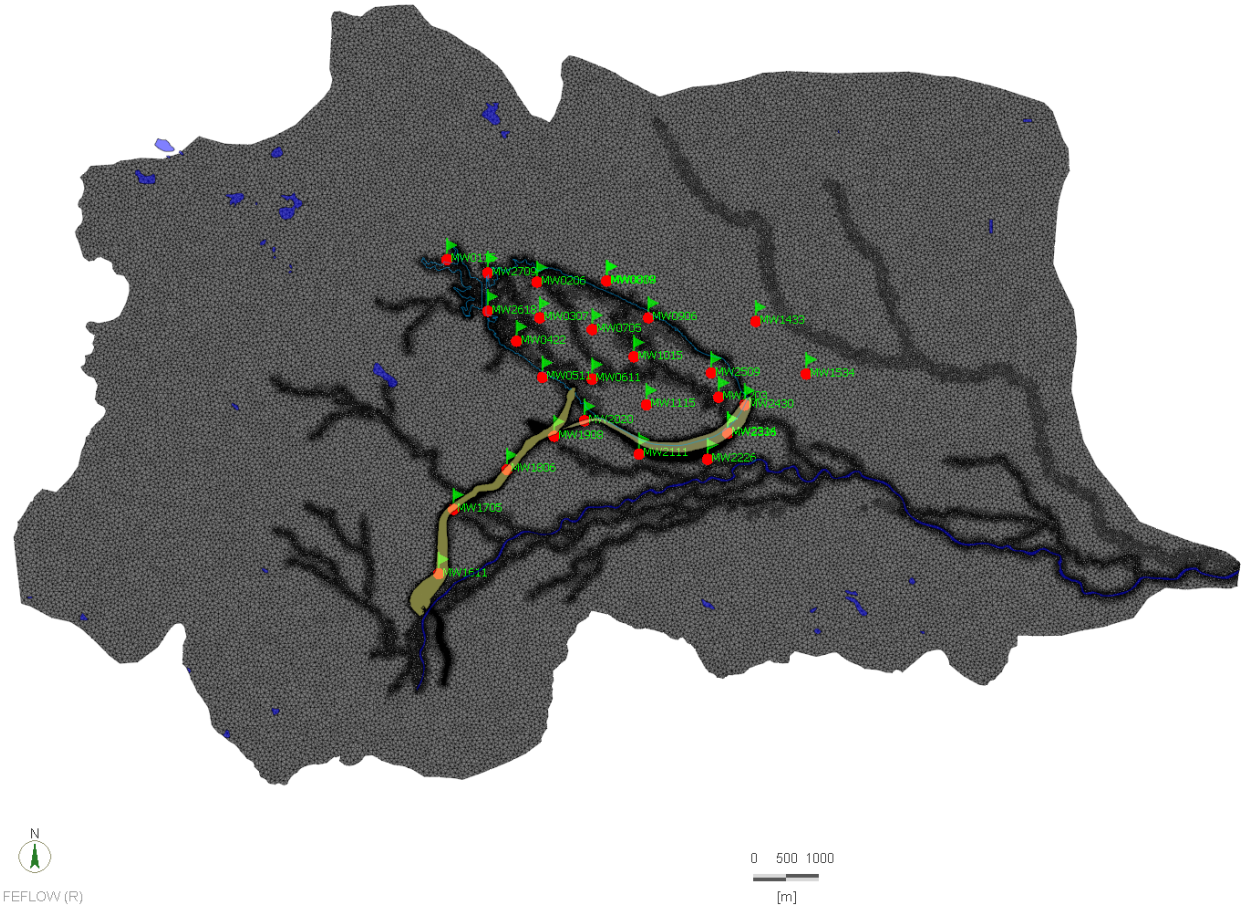

Figure 5-1 Location of Calibration Targets within RAA

The model was based on non-calibrated hydraulic properties (e.g. hydraulic conductivities). After calibration, the vertical distribution of the hydraulic conductivities within the shallow bedrock was manually adjusted to represent areas of both higher and lower yield bedrock. Consequently, different hydraulic conductivity values were defined for different bedrock zones, as presented in Table 5-1.

Table 5-1 Shallow Bedrock Hydraulic Conductivity Zones

Hydraulic conductivity (m/s)-West Zone	Hydraulic conductivity (m/s)-Central Zone	Hydraulic conductivity (m/s)-East Zone
3.28e-7	3.40e-6	4.27e-9

5.2 RESIDUAL ANALYSIS

Residual analysis compares the differences between the simulated model results and the associated field-based observations. This analysis is completed to identify any trends in the residuals that could be based on geographical or temporal variation.

Four statistical parameters were used to evaluate the degree of fit, including the mean residual, mean absolute residual, the normalized root mean squared residual (NRMS) and the correlation coefficient. A groundwater model can be considered to be calibrated adequately if:

- The mean error is close to zero.
- The absolute mean error is as small as possible in consideration of the scale of the model.
- The NRMS residual is less than 10% (Spitz and Moreno 1996).
- The correlation coefficient is close to the perfect correlation value of one.

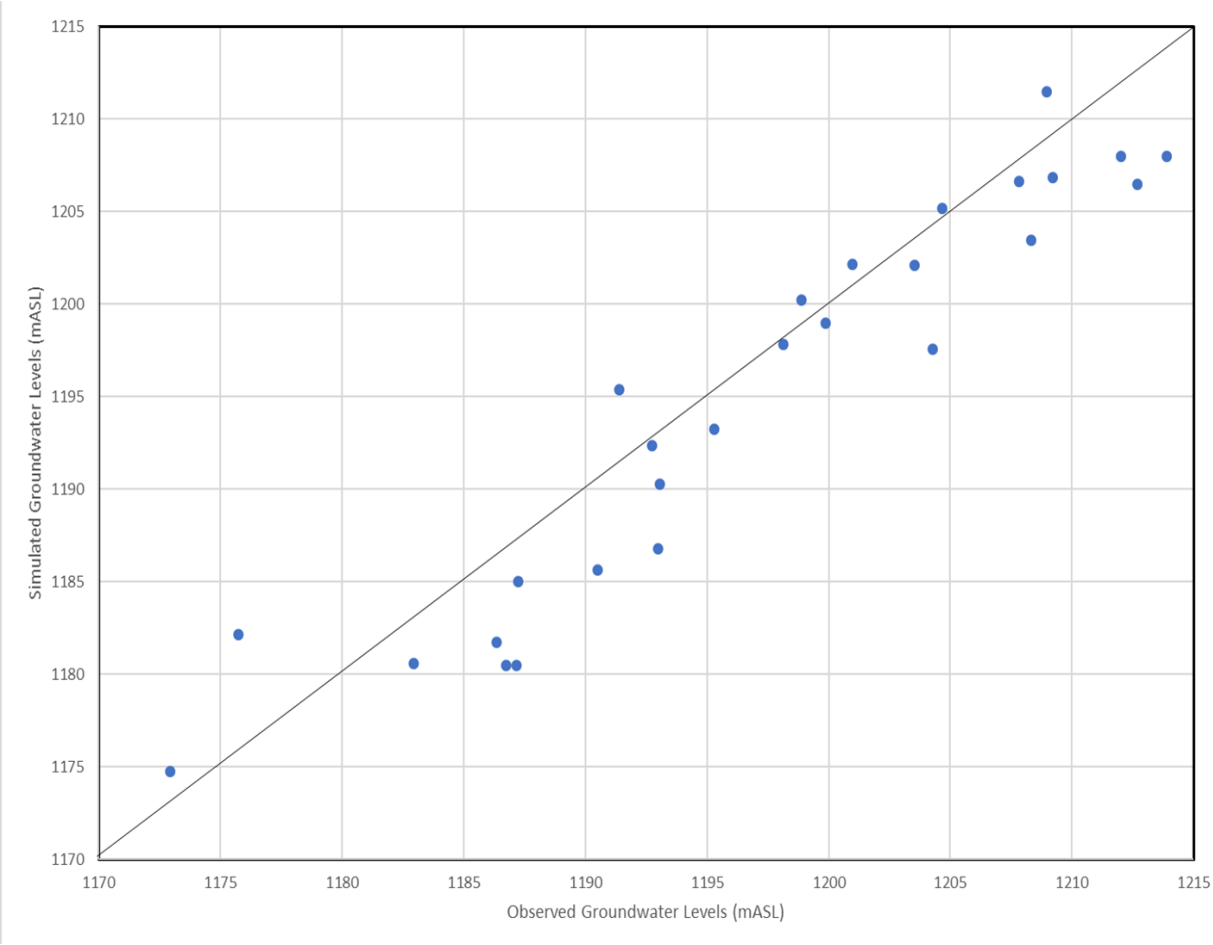

Figure 5-2 Comparison of Observed and Simulated Water Levels at end of Calibration

The match of the simulated groundwater levels in the model are compared to the observed values in Figure 5-2, and the residual statistics are presented on Table 5-2. Based on evaluation of Figure 5-2 and Table 5-2, the overall fit of the model is acceptable. The mean error is -2.03 m, the absolute mean error is 3.34 m, the NRMS residual is 9.7%, and the correlation coefficient is 0.95.

Table 5-2 Residual Statistics from Groundwater Flow Modelling

Parameter	Value
Number of Observations	31
Mean Residual	-2.03 m
Absolute Mean Residual	3.34 m
Normalized Root Mean Squared Residual	9.7%
Correlation Coefficient	0.95

Residual is calculated as the simulated value minus the actual observed value.

Systematic bias in the simulations are evaluated by comparing the residuals to the simulated water levels (Hill and Tiedeman 2006). The plot presented in Figure 5-3 should have a zero slope and the regression coefficient should be close to zero. The plot of the residuals against the simulated water levels presented has a slope of 0.0017 and a regression coefficient of 0.0005, which are both indicators of a lack of systemic bias.

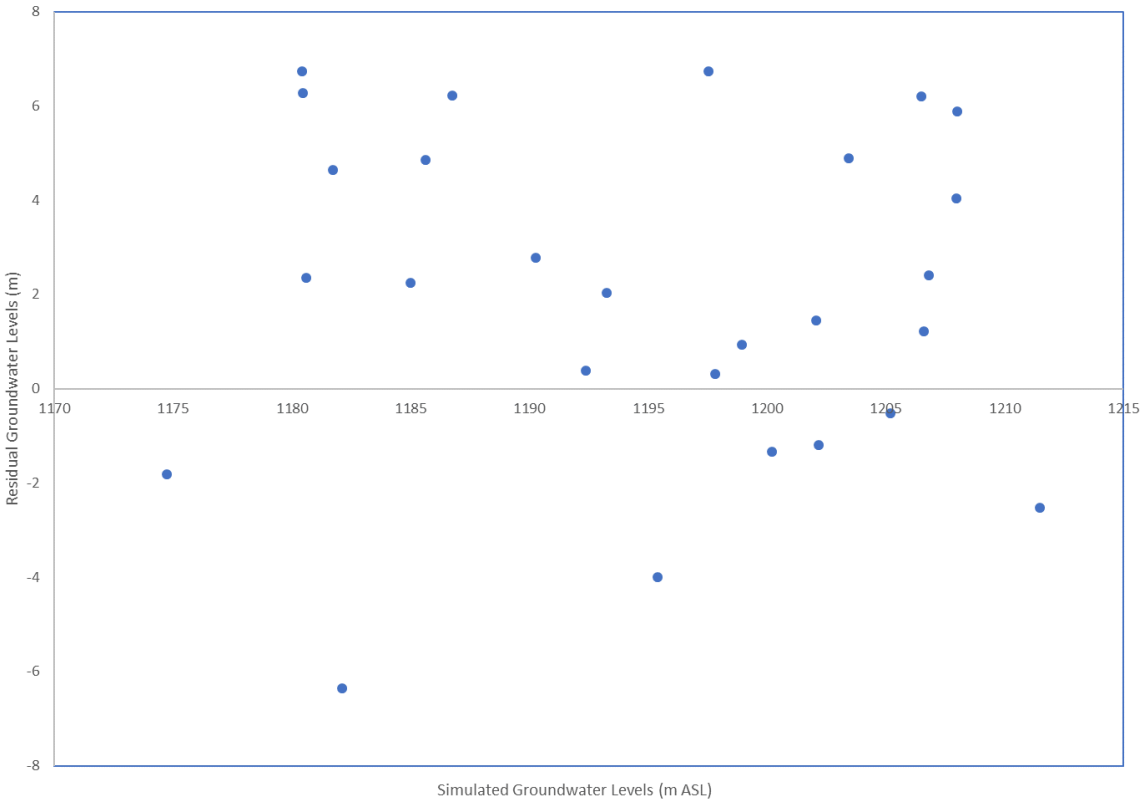

Figure 5-3 Comparison of Residual Water Level to Simulated Water Level at the end of Calibration

6.0 SIMULATED POTENTIAL EFFECTS OF FLOODS

The FEFLOW model was used to simulate hydrogeologic conditions in the RAA during four flows:

- hydrogeologic conditions during non-flood periods of average flow in Elbow River
- The design flood
- A 1:100 year flood
- A 1:10 year flood

The hydrographs for the design, 1:100 year and 1:10 year floods are shown in Figure 6-1.

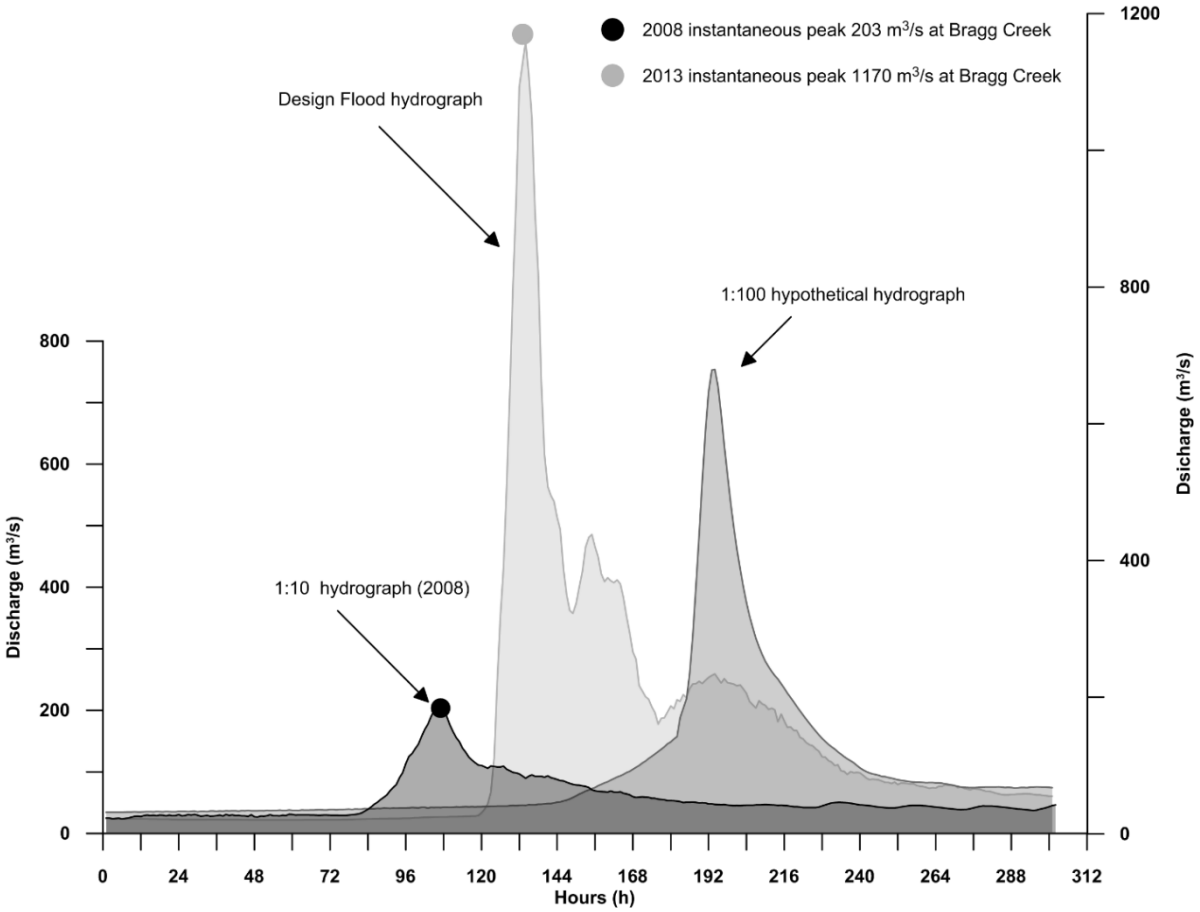

Figure 6-1 Design Flood, 1:100 Year Flood and 1:10 Year Flood Hydrographs

Numerical groundwater modelling of each of the floods is based on the project diversion operational rules and modelled surface water elevations. Diversion starts when flows exceed 160 m^3/s with increasing diversion occurring until flows in the diversion channel reach a maximum of 600 m^3/s. Any flow remaining in the Elbow River above 760 m^3/s (160 m^3/s plus 600 m^3/s) is allowed to pass downstream while 600 m^3/s is continuously diverted into the diversion channel.

For each of the floods, two FEFLOW simulation runs were completed to represent hydrogeologic conditions without the project operating and operation conditions, yielding a total of eight simulation runs; these are summarized in Table 6-1. The EE-series of simulations (without the project operating) represent the hydrogeologic system in the RAA under various flows. The PP-series of simulations (project operation) represent the hydrogeologic system in the RAA under various flows with the major project features (diversion channel, off-stream reservoir) represented in the model.

Table 6-1 Summary of Numerical Groundwater Model Simulation Runs

Floods in Elbow River	Numerical Model Simulation Run		Effects Evaluated
	Without Project Operation (Existing Conditions)	With Project Operation	
Average Flow Conditions (No Flood)	EE0	PP0	Dry Operations
Design Flood	EE1	PP1	Flood Operations
1:100 Year Flood	EE2	PP2	Flood Operations
1:10 Year Flood	EE3	PP3	Flood Operations

Each of the simulations were run within the FEFLOW model using a constant time step over the entire simulation period. The simulation period varied between runs, depending upon the flood hydrographs, water retention time in the off-stream reservoir, and associated water release times. Additional simulation time was added to represent the post-flood period following complete release of water from the off-stream reservoir such that recovery of groundwater levels could be simulated.

Following each of the simulation runs, output files from FEFLOW were exported for post processing and interpretation. Each of the output files detail simulated potentiometric heads at each of the model nodes at each time step of the simulation. These output files were examined using spatial analysis tools to generate interpolated 3D potentiometric surfaces (at various timesteps in the simulation) that were then imported into the 3D CSM. Through examination of the 3D potentiometric surfaces over time, the dynamics of the hydrogeologic system in the RAA could be understood for the eight simulation runs.

6.1 SIMULATION RESULTS

In the following sections, the simulation results are evaluated through examination of the simulated extent of the effect, at varying points in time up to the end of the simulation period. For each specified time, a figure is presented showing the groundwater regime within the model boundary domain. Results for each of the four flow scenarios are also presented in succession such that comparisons can be made.

Simulation results that were used directly to support the effects assessment are presented in more detail in the hydrogeology effects assessment (Volume 3B, Section 5).

6.1.1 Average Flow Condition Simulation Under Existing Conditions (EE0)

The hydraulic head distribution for the EE0 simulation run is shown on Figure 6-2. This simulation represents existing conditions (no Project) under average, non-flood flow conditions in Elbow River.

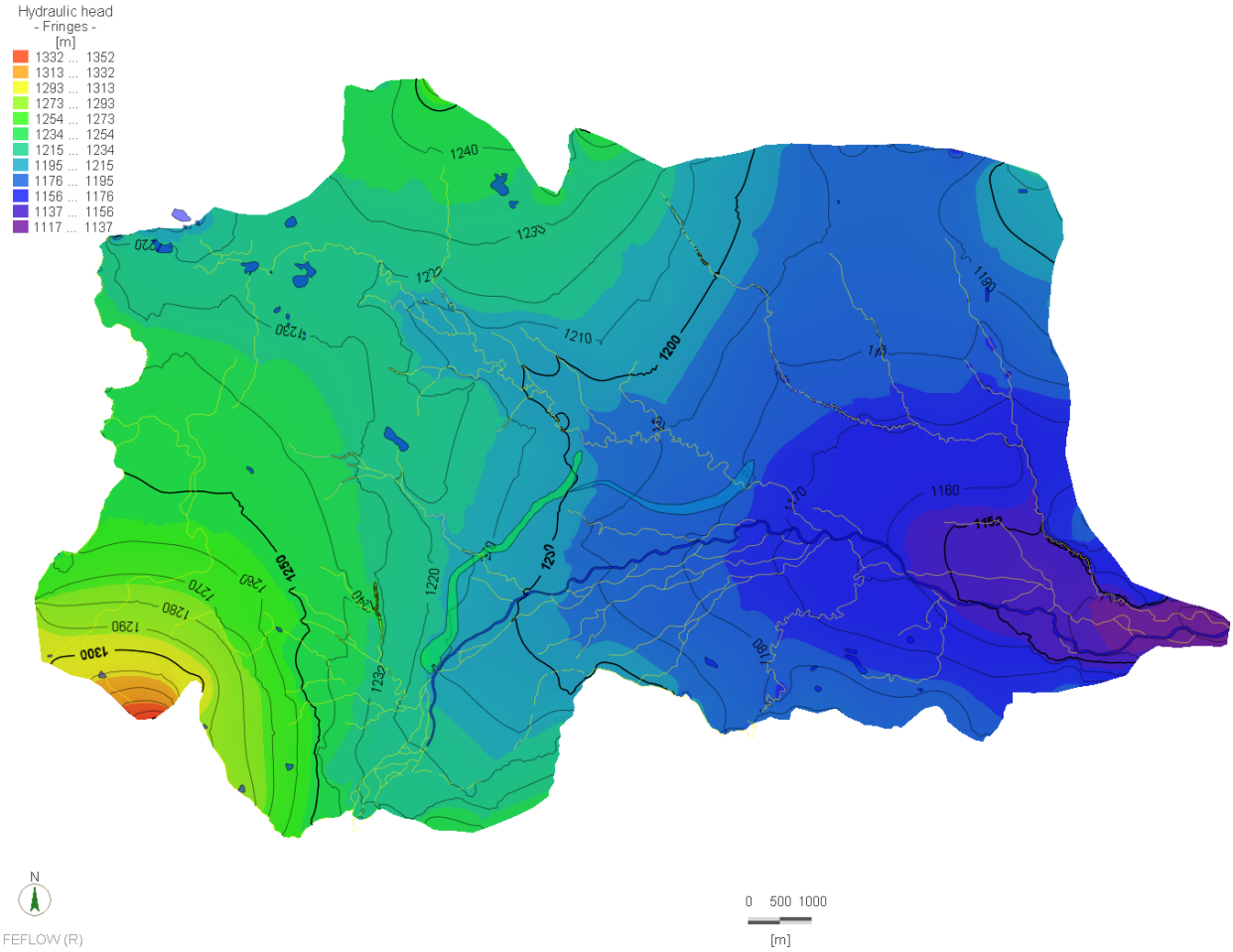

Figure 6-2 Groundwater Hydraulic Head Distribution – EE0 Simulation

6.1.2 Average Flow Condition Simulation with the Project (PP0)

The hydraulic head distribution for the PP0 simulation run is shown on Figure 6-3.

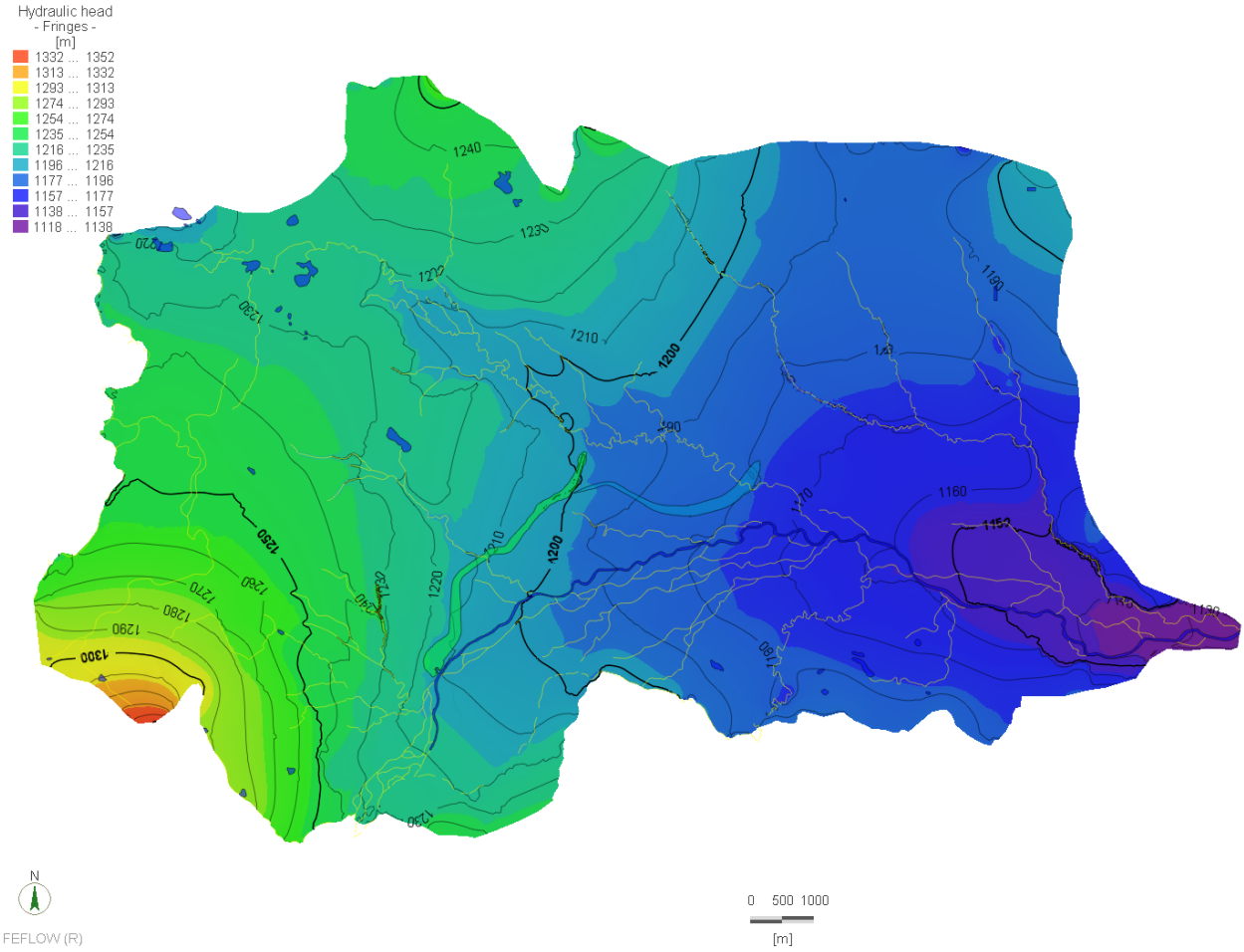

Figure 6-3 Groundwater Hydraulic Head Distribution – PP0 Simulation

6.1.3 Design Flood Simulation Under Existing Conditions (EE1)

The hydraulic head distribution for the EE1 simulation run is shown on Figure 6-4.

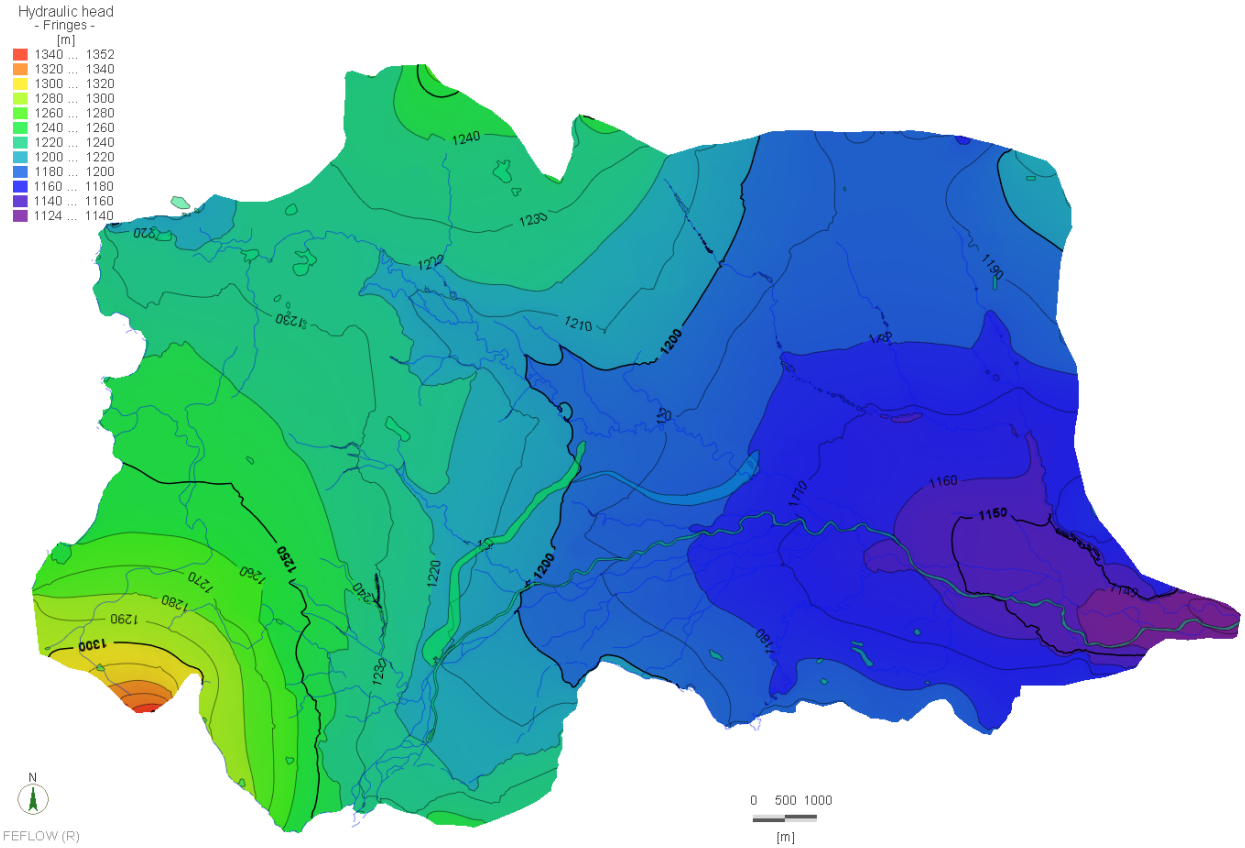

Figure 6-4 Groundwater Hydraulic Head Distribution – EE1 Simulation

6.1.4 Design Flood Simulation Under Project Operations (PP1)

The hydraulic head distribution for the PP1 simulation is shown on Figure 6-5.

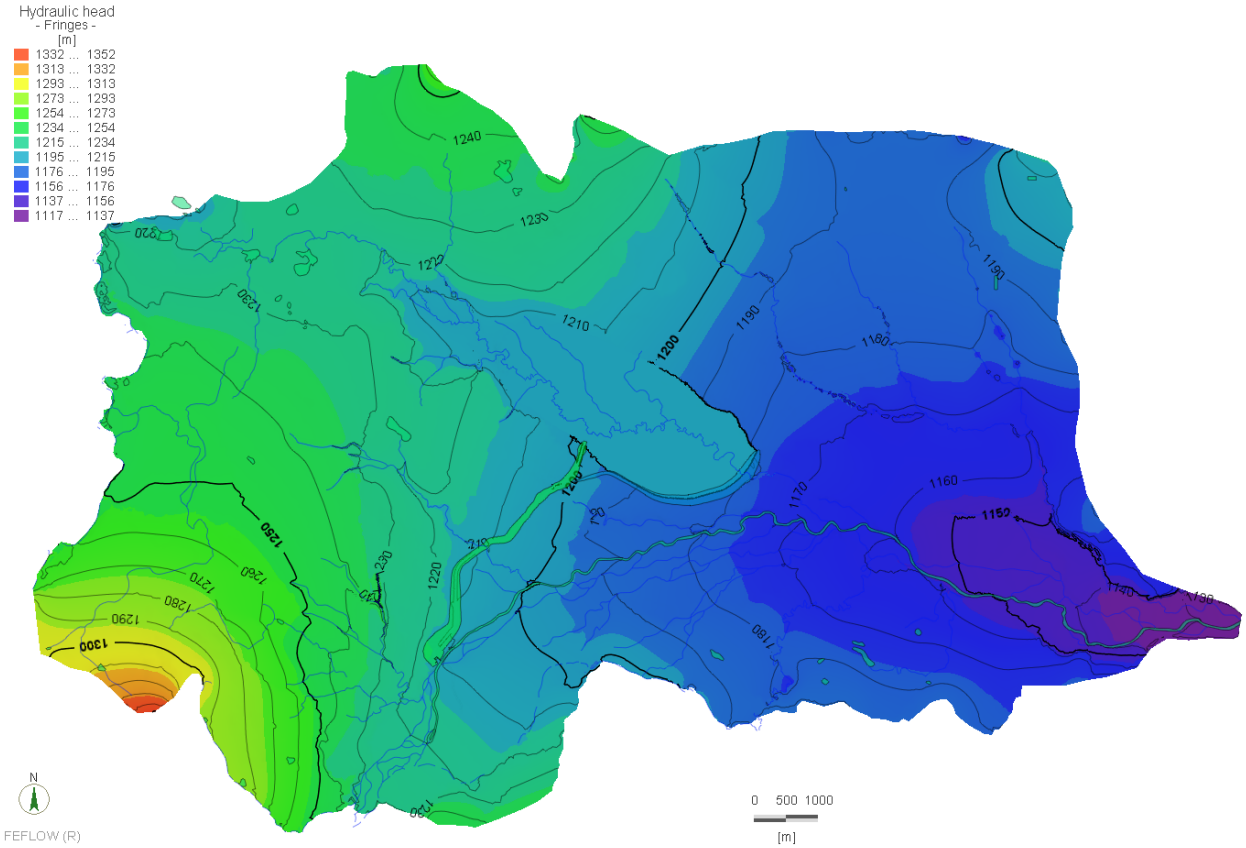

Figure 6-5 Groundwater Hydraulic Head Distribution – PP1 Simulation

Figure 6-6 presents (from top to bottom) the hydraulic head changes for both existing conditions (EE1) and under project operations (PP1) at the early stage of the design flood (top), at peak off-stream reservoir levels (middle), and post-flood operations (bottom).

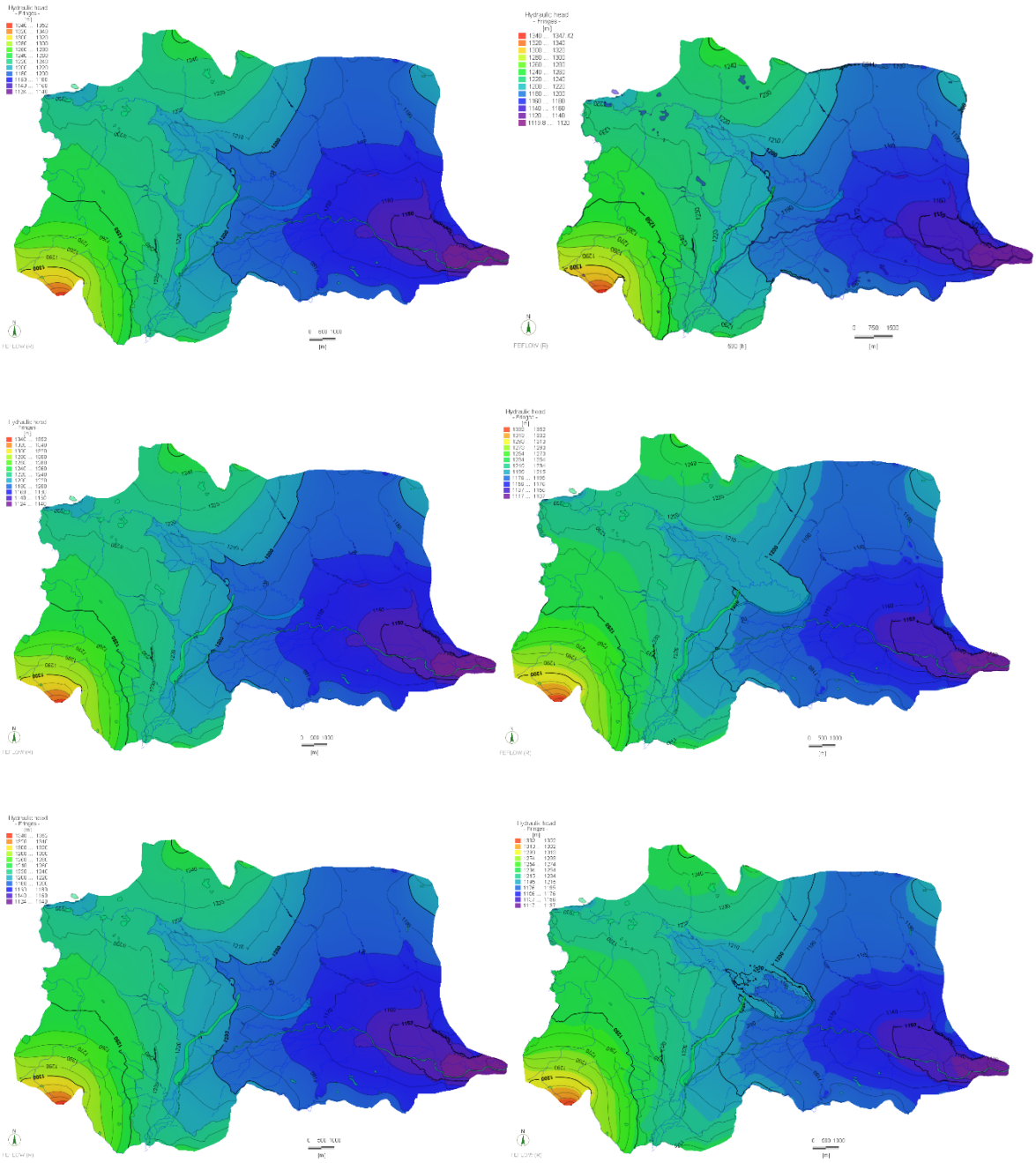

Figure 6-6 Temporal Groundwater Hydraulic Head Distributions Comparing Conditions During the Design Flood

A comparison between the peak and post-flood stages of the PP1 design flood scenario shows that the hydraulic head increased during the peak reservoir levels and decreased over the remainder of the simulation trending toward pre-flood conditions. However, the hydraulic head did not fully return to the pre-flood values within the specified time of the simulation as shown in Figure 6-6. By extending the simulation time, the pre-flood condition would be observed within the reservoir.

Figure 6-7 presents the locations of 5 control points (CP) used to assess temporal changes in groundwater levels at a given location, over the simulation period. The hydraulic head hydrographs for the EE1 and PP1 simulations are shown on Figure 6-8 and Figure 6-9. The simulated hydrographs shown in Figure 6-8 represent the hydraulic head changes at CP1, CP2, and CP3 which are located at 29, 184, and 202 m from the Elbow River. The simulated hydrographs shown in Figure 6-9 represent the hydraulic head changes at CP4 and CP5, which are situated approximately 156 and 204 m downstream of the off-stream dam (Figure 6-7).

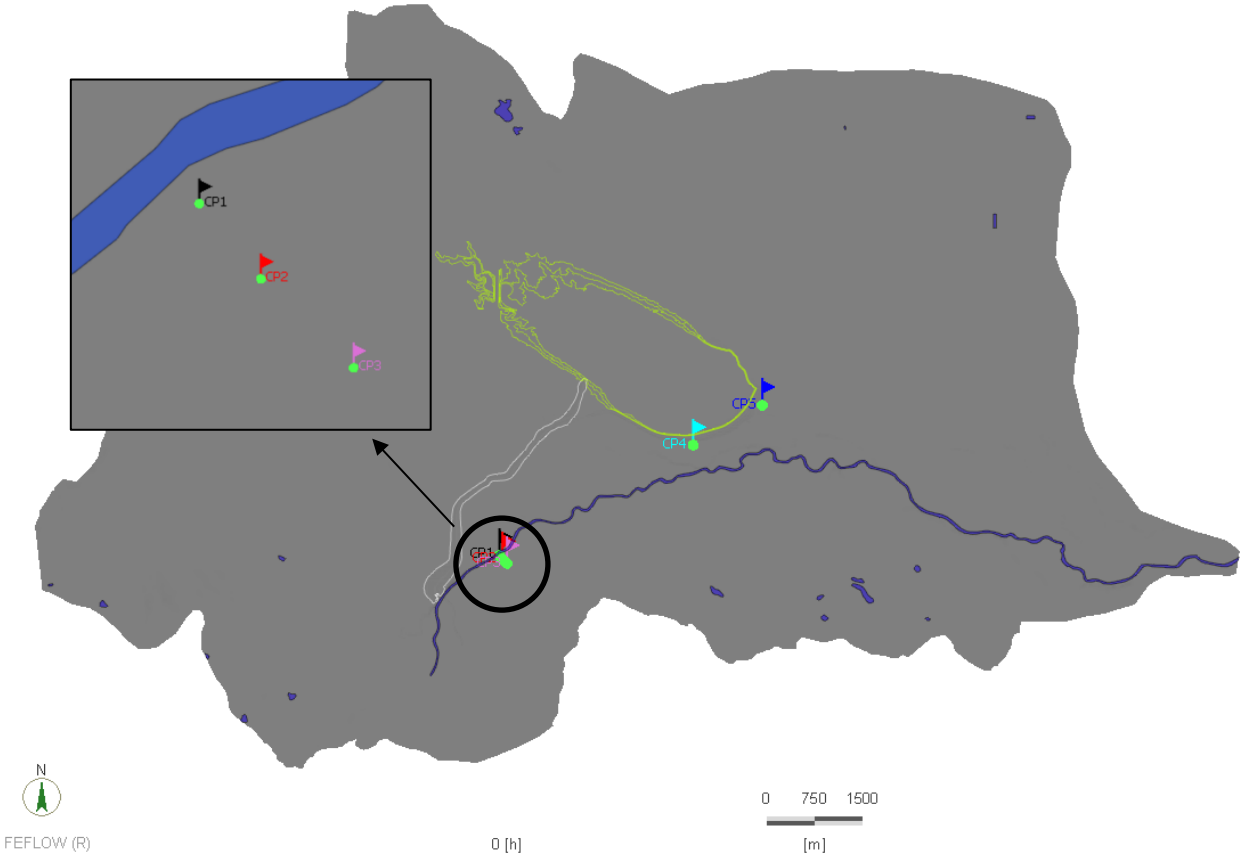

Figure 6-7 Locations of CP1 to CP5 at Elbow river and downstream of the flood area (diversion).

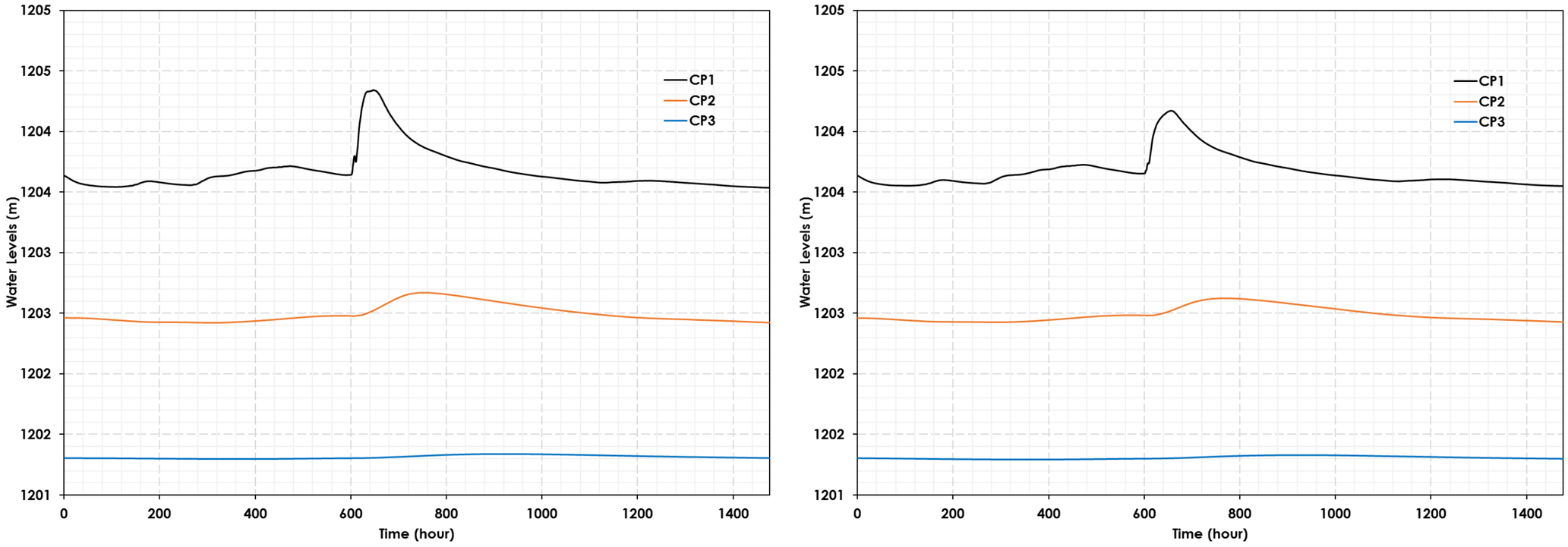

Figure 6-8 Simulated Hydrographs at Three Control Points in the Elbow River Valley During the Design Flood for EE1 (Left) and PP1 (Right)

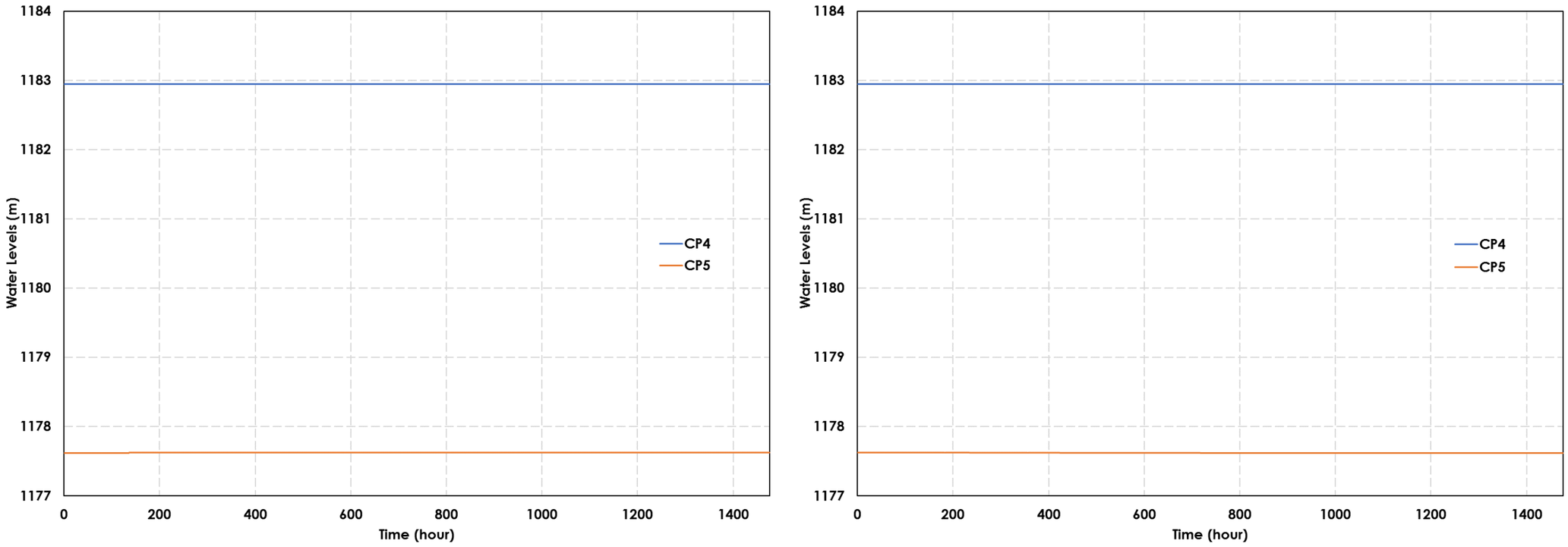

Figure 6-9 Simulated Hydrographs at Two Control Points Near the Off-Stream Dam During the Design Flood for EE1 (Left) and PP1 (Right)

6.1.5 1:100 Year Flood Simulation Under Existing Conditions (EE2)

The hydraulic head distribution for the EE1 simulation run is shown on Figure 6-10.

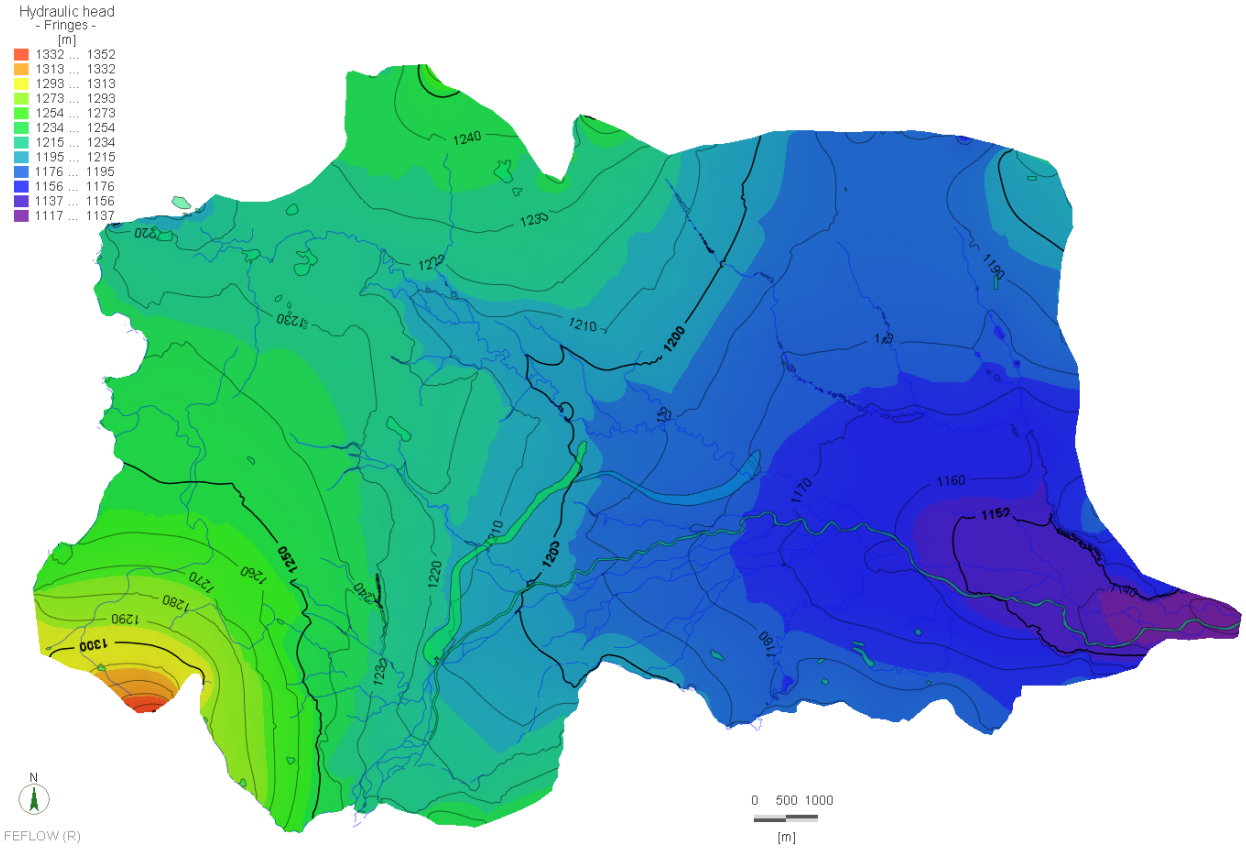

Figure 6-10 Groundwater Hydraulic Head Distribution – EE2 Simulation

6.1.6 1:100 Year Flood Simulation Under Post Operations (PP2)

The hydraulic head distribution for the PP2 simulation is shown on Figure 6-11.

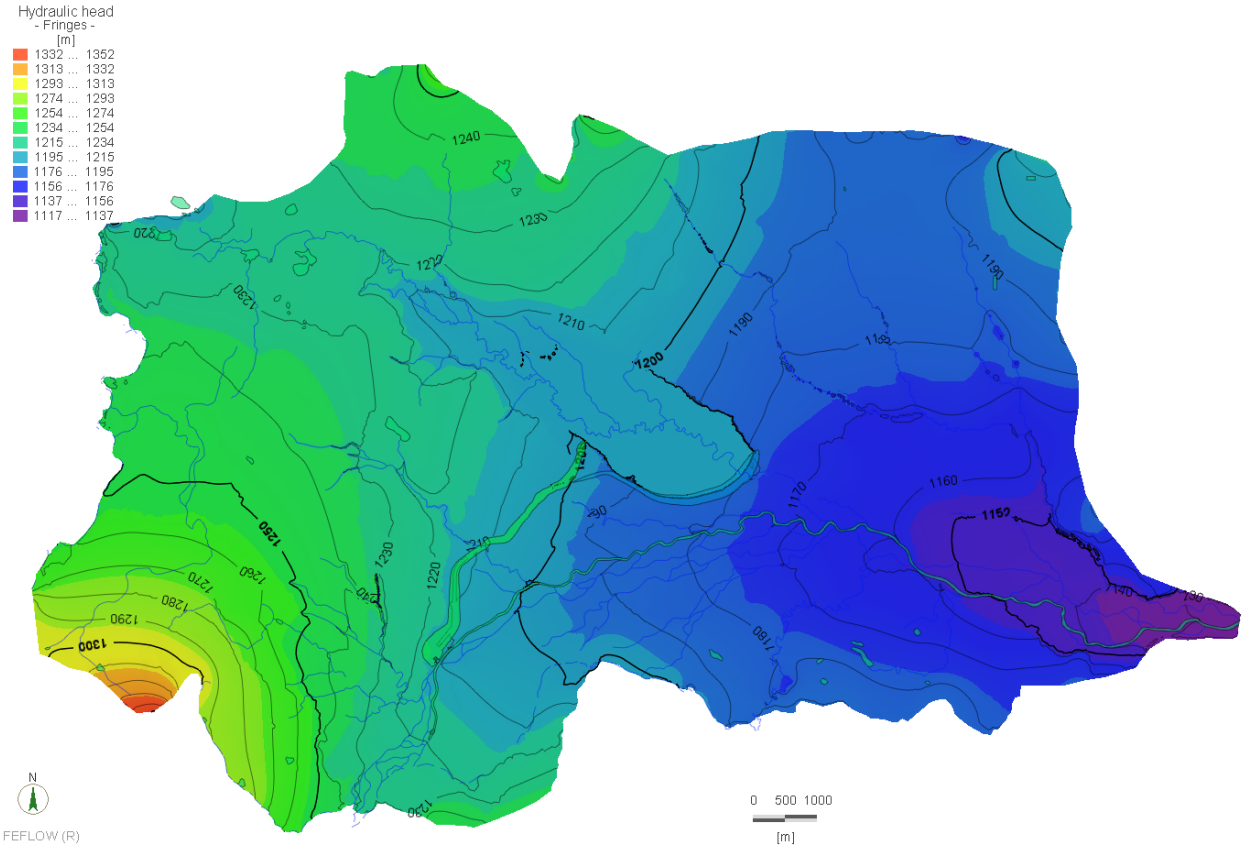

Figure 6-11 Groundwater Hydraulic Head Distribution – PP2 Simulation

Figure 6-12 presents (from top to bottom) the hydraulic head changes for both existing conditions (EE2) and under project operations (PP2) at the early stage of the flood (top), at peak off-stream reservoir levels (middle), and post flood operations (bottom).

The hydraulic head hydrographs for the EE2 and PP2 simulations are shown on Figure I6-13 and Figure 6-14. The locations of CP1 to CP5 are presented at Figure 6-7.

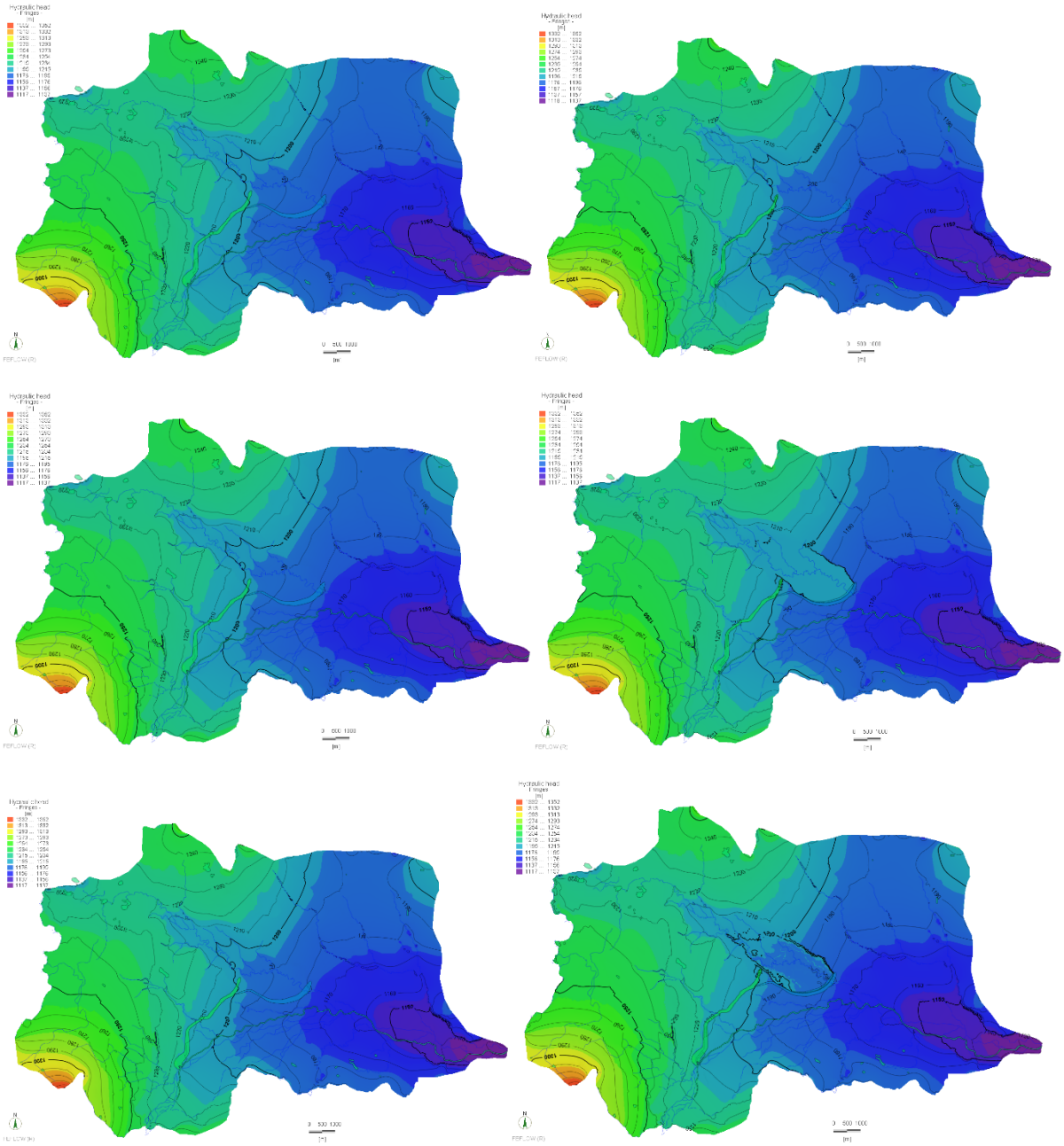

Figure 6-12 Temporal Groundwater Hydraulic Head Distributions Comparisons for the 1:100 Year Flood

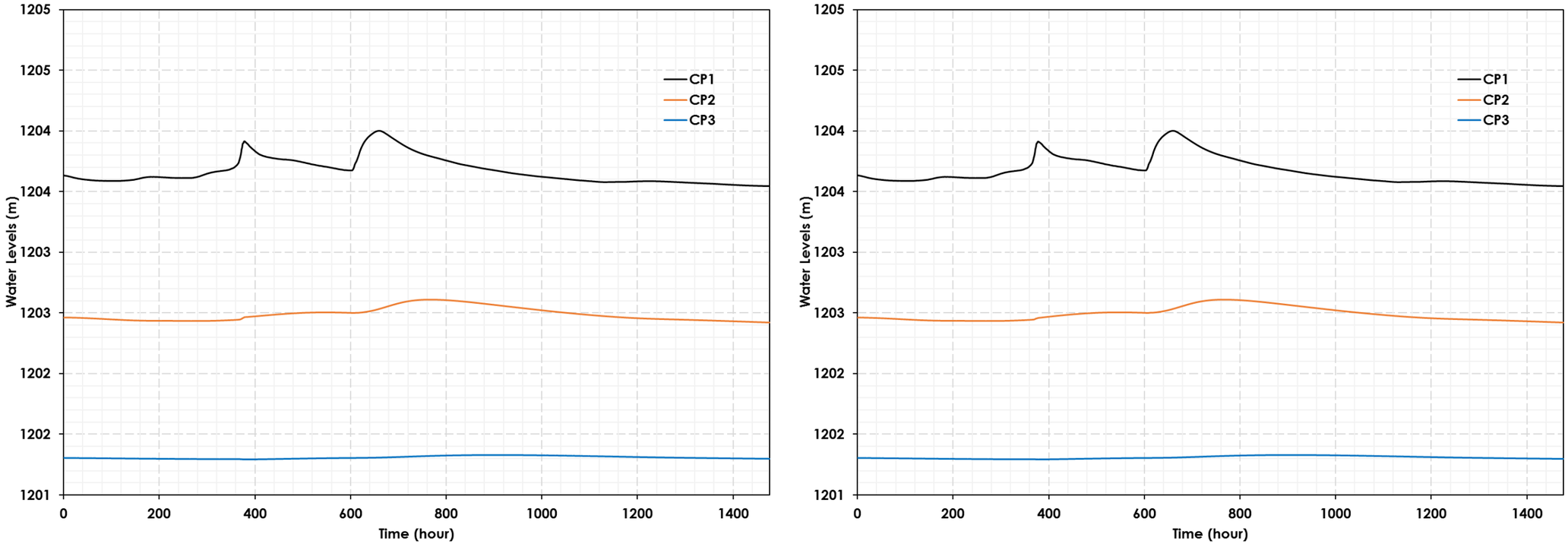

Figure 6-13 Simulated Hydrographs at Three Control Points in the Elbow River Valley for the 1:100 Year Flood for EE2 (Left) and PP2 (Right)

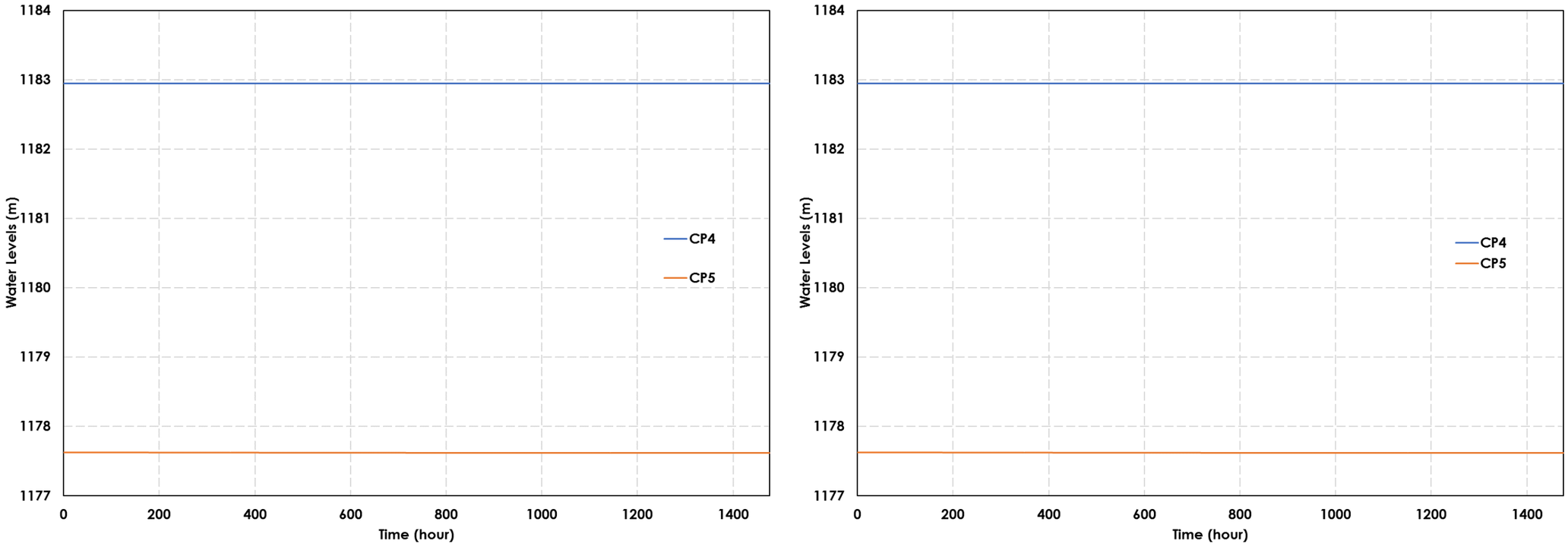

Figure 6-14 Simulated Hydrographs at Two Control Points Near the Off-Stream Dam During the 1:100 Year Flood for EE2 (Left) and PP2 (Right)

6.1.7 1:10 Year Flood Simulation Under Existing Conditions (EE3)

The hydraulic head distribution for the EE3 simulation is shown on Figure 6-15.

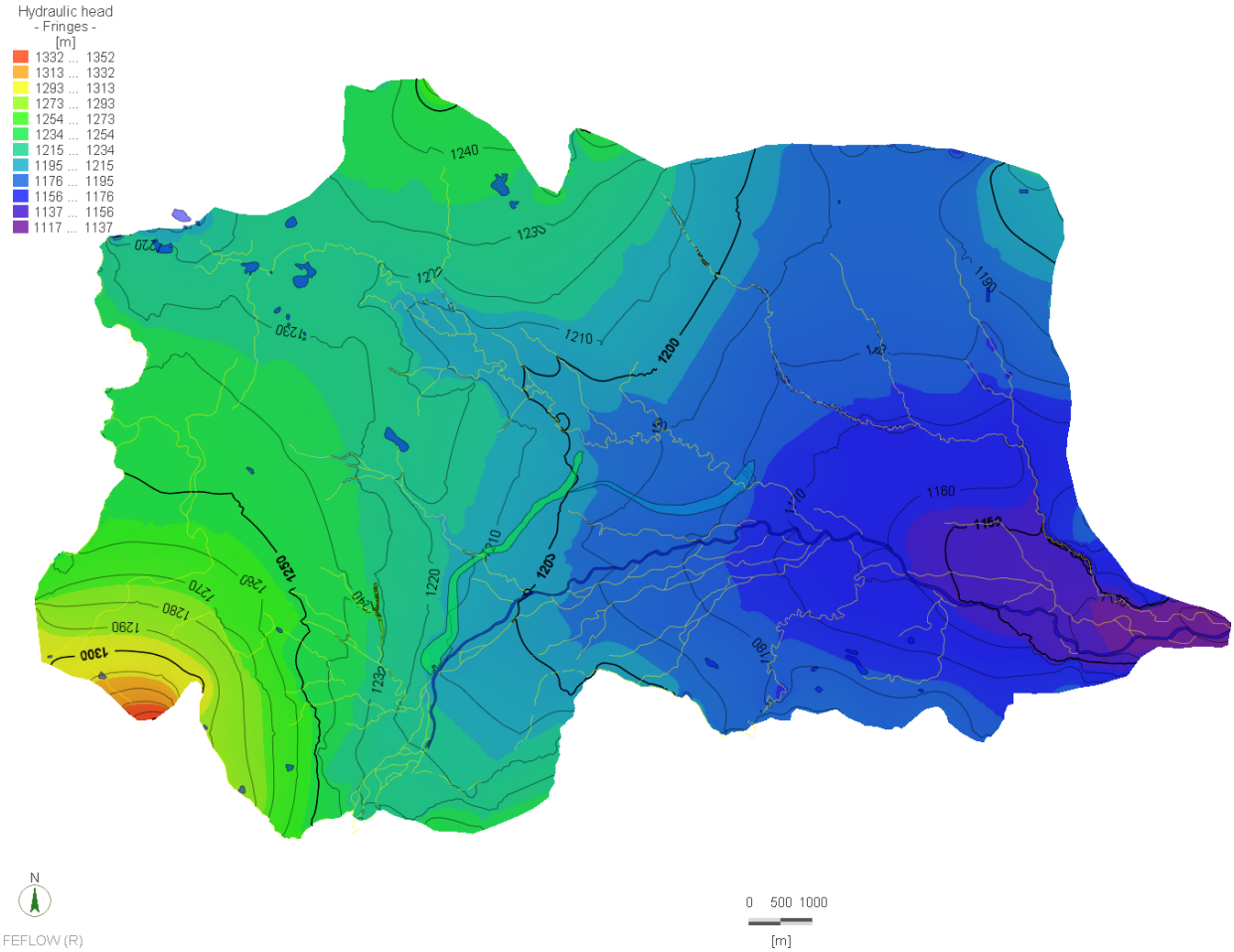

Figure 6-15 Groundwater Hydraulic Head Distribution – EE3 Simulation

6.1.8 1:10 Year Flood Simulation Under Project Operations (PP3)

The hydraulic head distribution for the PP3 simulation is shown on Figure 6-16.

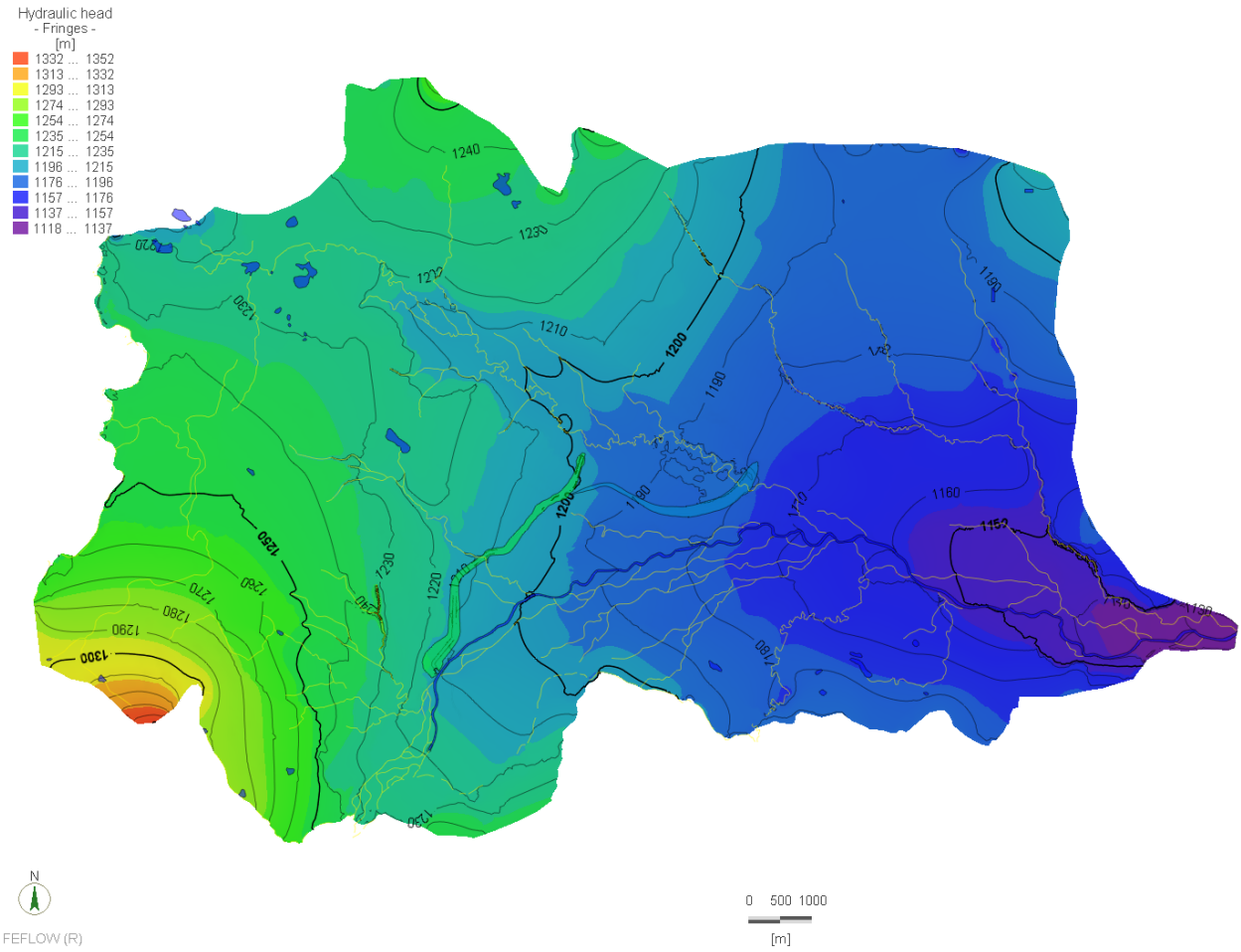

Figure 6-16 Groundwater Hydraulic Head Distribution – PP3 Simulation

Figure 6-17 presents (from top to bottom) the hydraulic head changes for both existing conditions (EE3) and under project operations (PP3) at the early stage of the flood (top), at peak off-stream reservoir levels (middle), and post flood operations (bottom).

The hydraulic head hydrographs for the EE3 and PP3 simulations are shown on Figure 6-18 and Figure 6-19. The locations of CP1 to CP5 are presented in Figure 6-7.

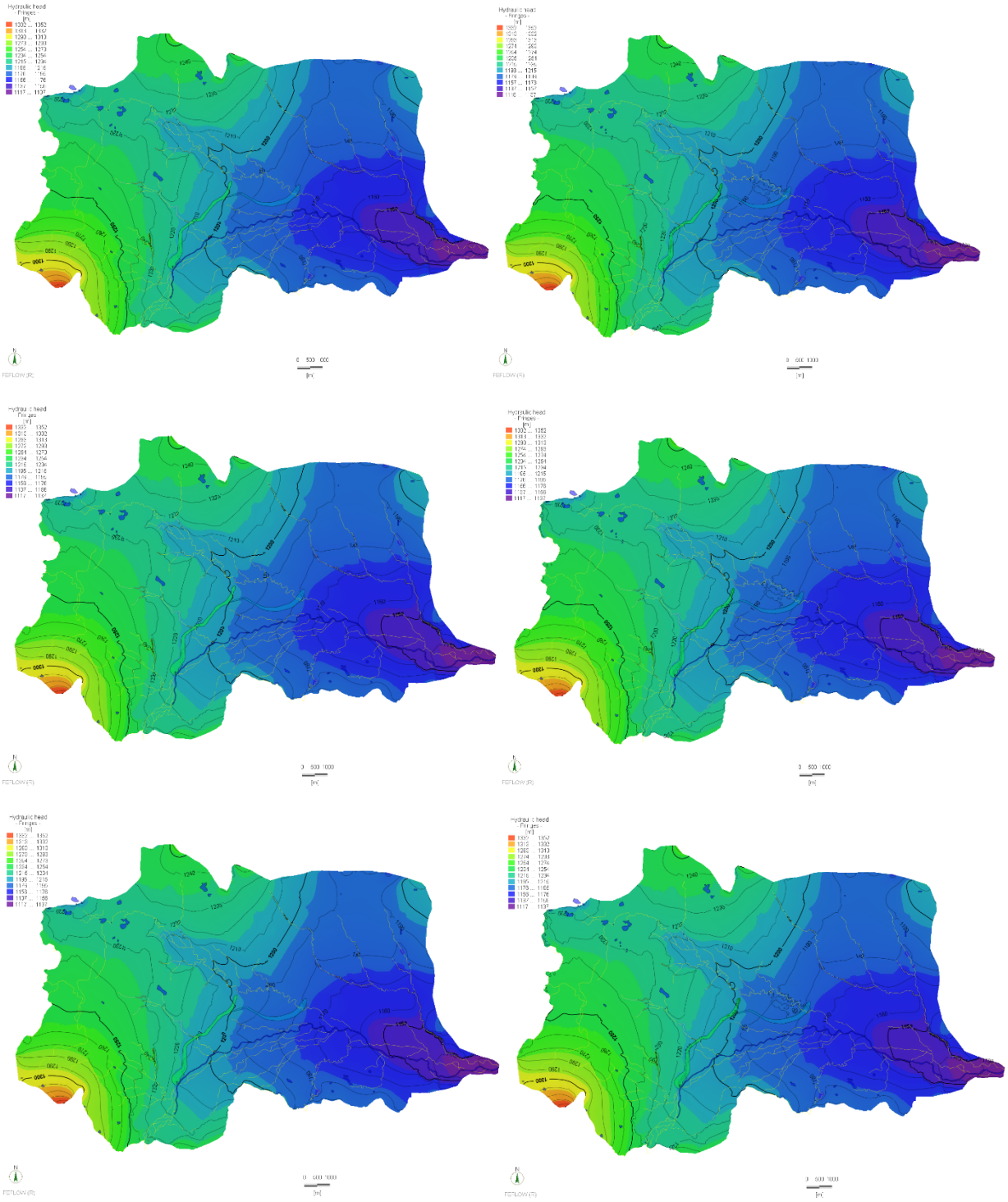

Figure 6-17 Temporal Groundwater Hydraulic Head Distributions Comparisons for the 1:10 Year Flood

Simulated Potential Effects of FLoods
March 2018

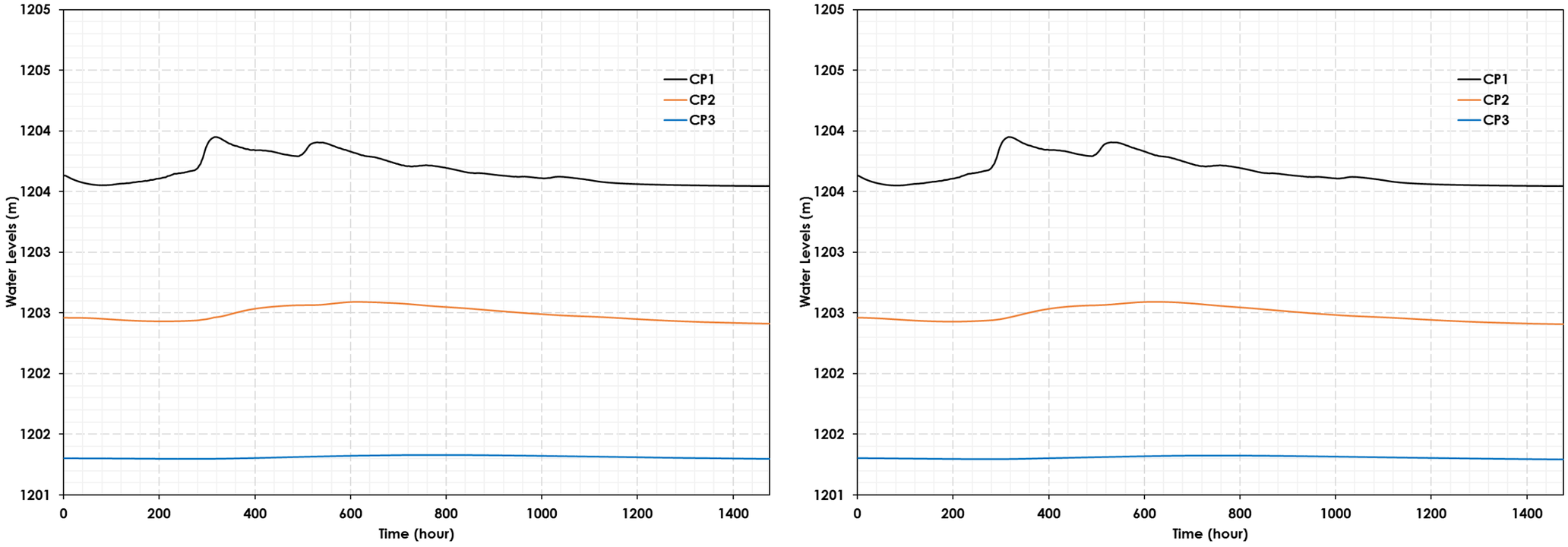

Figure 6-18 Simulated Hydrographs at Three Control Points in the Elbow River Valley During the 1:10 Year Flood for EE3 (Left) and PP3 (Right)

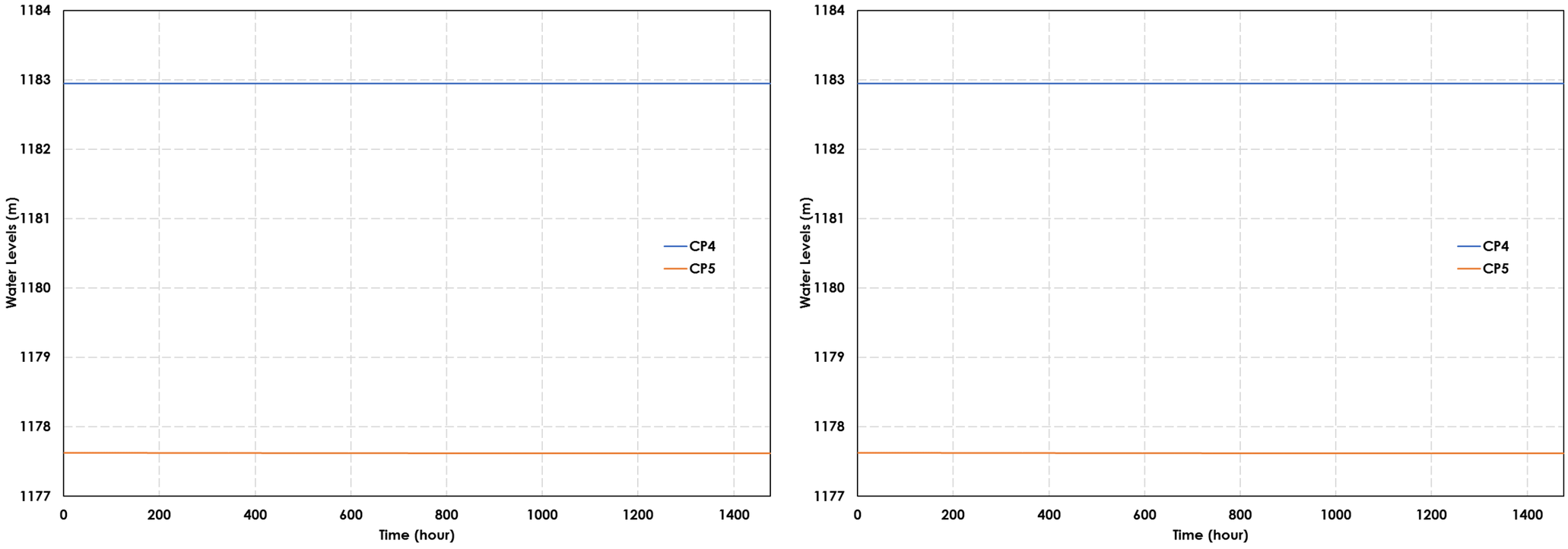

Figure 6-19 Simulated Hydrographs at Two Control Points Near the Dam During the 1:10 Year Flood for EE3 (Left) and PP3 (Right)

7.0 SUMMARY

The results of a series of the modeling scenarios show that the groundwater levels and flow patterns are altered within the vicinity of the proposed Project. Changes are observed within the reservoir area during flooding and recede toward pre-flood conditions following floods. Changes in the groundwater flow regime are also observed along the proposed diversion channel. Modeling results that were used directly to support the hydrogeology effects assessment are further presented in Volume 3B.

8.0 REFERENCES

DHI-WASY. 2010. FEFLOW Users Guide. http://www.feflow.info.

Hill, M.C. and C.R. Tiedeman. 2006. Effective Groundwater Model Calibration. Wiley Interscience, Hoboken, New Jersey, 455 pp.

Istok, J. 1989. Groundwater Modeling by the Finite Element Method: Water Resources Monograph 13. American Geophysical Union, Washington, 495 pp.